

KEYWORD MNEMONIC AND CONTEXTUAL ANALYSIS STRATEGY INSTRUCTION
WITH AT-RISK ADOLESCENTS

By

SHIRLEY N. FOX

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This work is dedicated to my parents,
Mildred R. and Lyle B. Fox, for their perpetual support
and inspiration for learning.

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Abstract of Dissertation Presented to the
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Shirley N. Fox

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Chairman: Dr. Cecil D. Mercer
Cochair: Dr. Cynthia C. Griffin
Major Department: Special Education

The purpose of this study was to compare at-risk adolescents' recall of geography vocabulary definitions among three treatments during an acquisition, short-term retention, and long-term retention phase. The teachers were randomly assigned to one of three instructional conditions using a teacher-provided keyword mnemonic strategy, a teacher-provided contextual analysis strategy, or a teacher-provided rote free-study strategy. The subjects' recall was measured with a written assessment of the targeted terms' definitions. An analysis of variance with repeated measures was computed to analyze the results.

Significant differences for treatment methods were found for the written assessments. Subjects in the rote free-study control condition recalled significantly more than did subjects in the other two conditions on acquisition and

long-term recall of geography terms' definitions. Subjects in the keyword mnemonic condition recalled significantly more definitions than did subjects in the contextual analysis condition for the first two weeks of vocabulary acquisition. No statistically significant difference was found between the mnemonic keyword and rote free-study control conditions on the short-term recall measures. These results have educational implications for at-risk adolescents who are required to learn definitions in their assigned coursework.

CHAPTER 1 INTRODUCTION

With the passage of P.L. 94-142 in 1975, extended services and programs have been provided for a select group of students who qualified for Exceptional Student Education (ESE) programs. These traditional special education services offer only minimal support towards helping students succeed in the education system. Not all students in need of extra services and programs qualify for ESE programs; such students are considered "at-risk" for school failure and are identified as those who will encounter difficulty graduating from high school. These at-risk students are not handicapped according to the provisions stated in P.L. 94-142, but have been identified by many other categories in the past; i.e., culturally deprived, low-income, dropout, low-achieving, or disadvantaged (Presseisen, 1988).

Public concern regarding the numbers of students who drop out before graduating from high school has increased during the 1980s and 1990s. Calculating dropout rates is difficult because of definitional and data inconsistencies. However, high school graduation rates represent a stable measure of this ever-growing problem. In 1986, slightly less than three quarters of the nation's 18- and 19-year-olds had completed high school (Kolstad & Owings, 1986). Cooper

(1990) reported that 28.9% of our nation's high school students fail to graduate. High school completion rates, however, vary across districts. The lowest rates are found in urban areas and in African American and Hispanic populations (Pallas, 1987). The costs of our national dropout problem are reflected in higher welfare expenditures, lost tax revenues, and increased crime and crime prevention costs (Catterall, 1985). The intangible costs to individuals, families, and society are also noteworthy.

Our nation's schools are generating 3,600 new high school dropouts each day (Cooper, 1990). Despite increasing numbers of students in Florida schools, the number of high school graduates has decreased from 90,000 in 1981 to 82,000 in 1987. Sixty-two percent of the nation's high school seniors are graduated (Hodgkinson, 1988a). The dropout problem has been particularly acute in large urban school districts such as the Orange County, Florida, Public School System. In that system, during the 1991-92 school year, 326 middle and 1,415 high school students dropped out of school. The Orange County public school system is the 18th largest district out of more than 16,000 school districts in the nation and is the sixth largest in Florida (Orange County Public Schools, 1992).

Kaplan and Luck (1977) noted several characteristics common to at-risk students: academic underachievement,

antisocial behaviors, academic failure, and truancy. Pallas (1987) also reviewed the data on reasons students drop out of school and concluded that poor academic performance was the best predictor of who drops out of school. Presseisen (1988) further identified reading as the most critical weakness of at-risk students. She stated that a student who is not proficient at reading text is headed for school failure. Today's educators face the challenge of teaching students who are at-risk for school related problems and must alter the traditional education program for these students to succeed in the mainstream. Even though previous research has enabled the determination to be made that severe academic deficiencies exist among at-risk students, little is known regarding optimal instructional strategies for content area learning with this population. Stringer (1973) suggested that at-risk students who continue their education in the mainstream of regular classes without intervention will most likely experience long-range failure and will eventually become a school dropout.

Many students experiencing academic problems also exhibit problems with understanding and using language. Smith, Goodman, and Meredith (1970) explained that "language may be viewed as either an external verbalization about things or as an integral part of the personal process of experiencing and knowing . . . language is the very heart of

the teaching-learning process" (p. 68). Smith et al. (1970) viewed teaching and learning mainly as language games and believed that these language games are a basis to being successful in the education system. In addition, Brown (1985) compared poor readers with good readers and determined that poor readers lacked strategies in comprehending the meaning of what they read. Researchers studying at-risk students support the belief that if these deficiencies continue to exist as a student goes through the educational system, the student burdened with below-average reading scores is twice as likely to drop out of school as are students who have achieved average or above average reading levels (Presseisen, 1988). Similarly, Torgesen and his associates (Torgesen, 1977; Torgesen & Goldman, 1977; Torgesen & Licht, 1983) have also compared good and poor readers and suggested that some students do not achieve to their potential because either they are unable to develop and use efficient strategies, or they lack the motivation to do so.

Much of Torgesen's research comparing good and poor readers has focused on memory tasks. He suggested that the differences between good and poor readers may be the result of differences in general cognitive strategies underlying not only performance on experimental memory tasks, but also on the attainment of reading vocabulary and comprehension, as

well as other academic skills (Torgesen & Kail, 1980). Torgesen and Goldman (1977) studied second graders and found that, even with familiar stimuli, poor readers were deficient in the use of simple active strategies like rehearsal. Differences between good and poor readers in the use of more complex strategies have also been reported (Graves, 1987; Torgesen, Murphy, & Ivey, 1979). Researchers support the need for students to develop strategies for learning vocabulary words, increasing comprehension, and developing an attitude towards vocabulary and reading that will encourage students to apply these strategies (Graves, 1987; Marfo & Ryan, 1990).

Most schools do not provide specialized instruction for those students who experience difficulty in learning vocabulary terms. It is the responsibility of regular educators to teach at-risk students who have deficits in vocabulary acquisition. Many different methods have been recommended for teaching vocabulary (Gipe, 1979; Johnson & Pearson, 1978; Levin, 1981a). Students have been taught vocabulary by such traditional approaches as drilling with flashcards, writing the definition from a dictionary, using context clues, and free-study. Although, two particular methods are prevalent in the current literature: the keyword method, which is a mnemonic method; and learning from context, which expounds upon generalization skills (Condu-

Marshall, & Miller, 1986; Kroll, 1990; Levin & Levin, 1990; Scruggs & Mastropieri, 1990); a review of the research literature reveals that the effectiveness of these and other methods for teaching students who have been identified as at-risk for dropping out of school before graduation is limited.

Statement of the Problem

The focus of the present study was to determine the achievement of at-risk students taught three methods of vocabulary instruction for learning geography terms (i.e., mnemonic keyword strategy, contextual analysis strategy, and rote free-study strategy). Many middle school teachers in the mainstream teach vocabulary by the traditional methods of drill and practice (Chall, 1987). Since the rote free-study technique represents an approach that is typically used to teach middle school students vocabulary terms, this group served as a control group. Specific research questions regarding vocabulary instruction through keyword mnemonics, contextual analysis, and rote free-study for at-risk students answered in this investigation included the following:

1. Are there any significant differences among the three instructional groups on vocabulary acquisition measures?

2. Are there any significant differences among the three instructional groups on short-term vocabulary retention measures administered at the end of the instructional week?

3. Are there any significant differences among the three instructional groups on long-term vocabulary retention measures two weeks after vocabulary instruction?

The question of which techniques are effective for teaching at-risk students skills for vocabulary acquisition is important to investigate for several reasons. First, the study has provided data on teaching at-risk students vocabulary acquisition skills using a mnemonic keyword method, contextual analysis technique, and rote free-study approach. Second, this study has provided regular education teachers with information regarding at-risk students' vocabulary retention after being taught specific vocabulary skills. Third, the study has contributed data related to the relationship between teaching vocabulary acquisition techniques and skill generalization among students experiencing academic failure. Finally, the study has provided information that may be useful in curriculum planning for promoting additional ways for at-risk students to achieve academic success.

Purpose and Objective

The purpose of the study was to examine the effects of keyword mnemonics, contextual analysis, and rote free-study

conditions for learning geography terms taught to middle school adolescents who are at risk of not completing high school. The objective of the study was to determine the relative effectiveness of these three techniques in improving the vocabulary acquisition and retention of students identified as at risk for dropping out of school before graduation.

Rationale

Researchers and educators in the field of dropout prevention have been encouraging administrators and teachers to become more responsive to the needs of the at-risk adolescent (Gillespie, 1989; Toepfer, 1990). Legislators are also supporting the move for basic skills improvement and dropout prevention programs with the passage of P.L. 101-600 (1990), also known as the "School Dropout Prevention and Basic Skills Improvement Act of 1990." The intent of P.L. 101-600 is for the federal government to increase successful federally funded demonstration programs that increase the high school completion rate, encourage states to adopt specific plans to increase graduation rates, and enlist the assistance of community-based organizations in preventing students from dropping out of school (P.L. 101-600, 1990). P.L. 101-600 (1990) also includes the mandate that requirements for obtaining a certificate of graduation from a school not be lowered. During the 1980s, legislatures pushed

to improve public secondary schools by increasing graduation requirements. The increase in graduation requirements, as well as reports such as A Nation At Risk (National Commission on Excellence in Education, 1983) and Action for Excellence (Task Force on Education for Economic Growth, 1983), have increased the need for teachers to train students in specific strategies for successfully mastering the required skills and curriculum needed for completion of high school.

In 1989, the nation's Governors and the President established the National Education Goals Process, a framework to change the national educational emphasis from process to performance. The National Goals process has three essential parts. First, in early 1990, six national goals for educational improvements were developed to be the basis for Blueprint 2000. Second, the creation of the National Education Goals Panel took place later in 1990. The purpose of this panel was to report annually the state and national progress toward the six goals. Once a year, the panel provides a report with the most current information available on where the nation's progress towards achieving its goals stands. Third, the development of the National Education Standards and Assessments Council (NESAC) was promoted in 1992 to coordinate the development of standards of achievement and a system for assessing their attainment.

Goals two and five both focus on high school completion rates. Germany and Japan now have higher secondary school completion rates than the United States (National Education Goals Panel, 1992). The objectives in goal two include a dramatic reduction in the nation's dropout rate. Ninety percent of students who drop out of school are expected to successfully complete a high school degree or its equivalent by the year 2000. The second objective states that the gap in high school graduation rates between American students from minority backgrounds and their nonminority counterparts will be eliminated by the year 2000. The high school completion rate in 1991 was 85% for 19- to 20-year olds. Rates for African Americans and Anglo students were substantially higher than the rate for Hispanics.

This goal is important to attain for several reasons. A student who dropped out of school before graduating in 1990 can expect to earn less than one-half as much as similar youth in 1973 (National Education Goals Panel, 1992). Over a lifetime, this dropout will earn about \$200,000 less than a high school graduate. Another consequence of dropping out of school affects our economic system. One-half of welfare recipients failed to finish high school. Additionally, among the 1.1 million persons incarcerated in 1990, at a cost of \$22,500 a year per person, 82% were high school dropouts (National Education Goals Panel, 1992). Helping students

succeed in school and graduate is more cost effective than paying for the consequences of dropping out of school.

Goal five focuses on lifelong learning and literacy skills. In 1991, 97% of young adults had mastered the most basic functional literacy skills, but few were able to perform more complex tasks requiring the synthesis of many pieces of information (National Education Goals Panel, 1992). Students' failure to achieve academically and socially is a difficult problem to address due to the numerous and complex contributing factors.

One aspect of preventing school failure is to increase academic success. As students progress through the educational system, the curriculum places increasing demands on them for acquiring and memorizing information (Nagel, Schumaker, & Deshler, 1986). Student progress is typically assessed by written means that reflect factual recall (Blough & Schwartz, 1990; Mastropieri & Scruggs, 1991). Scruggs and Mastropieri (1993) examined assessment methods in content areas and revealed that 99% of all content assessments required direct recall of factual information. They also stated that the demands on vocabulary learning are particularly evident. Yager (1983) reported that more new vocabulary was introduced in some content textbooks than was presented in foreign language courses. Increasing student success on vocabulary learning is a beginning step towards

addressing the complex issues of reducing the dropout rate. Vocabulary knowledge may be one of the most important abilities for achieving school success (Scruggs & Mastropieri, 1993).

Exceptional educators have been providing and investigating numerous strategies and techniques to increase student success since the 1970s. Alternative instructional strategies that are effective with exceptional students may also be effective in regular education programs (Beech, 1989). Despite the similarities in academic failures between students who are at risk of dropping out of school and students who are staffed into exceptional education programs such as SLD, EMH, and EH, there has been little research on learning strategies for at-risk adolescents. With a better understanding of the effectiveness of specific instructional strategies for teaching at-risk adolescents, school systems may be able to plan and train regular educators to use these effective strategies and, thus, increase at-risk students' academic success.

In this study the researcher compared student performance of recall of unfamiliar geography terms when the students were provided instruction in learning the keywords and interactive illustrations, when the students were provided instruction in utilizing context clues, and when the students were instructed to use rote free-study techniques.

Definitions of Terms

An at-risk student is a student who is experiencing academic underachievement, antisocial behaviors, academic failure, and/or truancy (Kaplan & Luck, 1977) and is considered to be at risk of dropping out of school prior to graduation.

Contextual analysis is a strategy that refers to a reader's attempt to understand the intended meaning of a word by scrutinizing surrounding context (Johnson & Pearson, 1978).

A dropout is a student who has left the school system prior to graduation and is no longer attending school.

Imagery refers to mental images produced by memory or imagination.

An imagery link is an illustration that links the keyword to the definition of the vocabulary word via an illustration of a picture or an imagining of the keyword interacting in some way with a picture of the vocabulary word's definition.

Keyword mnemonic method is a strategy involving the association of the phonetic and visual imagery components of a word with its definition (Atkinson & Raugh, 1975).

Learning strategy refers to techniques, principles, or rules that enable a student to learn to solve problems and complete tasks independently (Deshler & Lenz, 1989).

Middle school refers to schools established to teach students in grade levels 6 through 8.

A mnemonic strategy is a device for organizing and/or encoding information through the creation and use of cognitive cueing structures (Bellezza, 1981).

Pictorial and graphic context clues are graphic devices such as pictures, charts, graphs, diagrams, tables, timelines, and maps that students may "read" to help comprehend new words, general concepts, and main ideas.

Recoding is the process that transforms unfamiliar, nonmeaningful stimuli into a more meaningful entity (Levin, 1983).

Relating is the process that integrates initially unrelated elements into a meaningful whole (Levin, 1983).

Rote free-study is the process of memorizing material by repetition or routine that is carried out mechanically, unthinkingly, and in any way that one can.

Semantic contextual clues are clues that include direct definitions or explanations, restatements, substitute words, figures of speech, comparison or contrasts, summary statements, inferences, subjective clues, and familiar expressions. The bulk of contextual analysis is semantic. There are many kinds of semantic contextual clues available to the reader.

Syntactic contextual clues do not provide direct definitions of unfamiliar words, but they do help a reader to decipher word meaning from word order. Certain grammatical form classes (parts of speech) "fit" in certain places in a structure where others do not.

The three "Rs" refers to the process of the keyword mnemonic strategy of stimulus recoding, semantic relating, and systematic retrieving of a mnemonic (Levin, 1983).

Typographical context clues are quotation marks, parenthesis, and definitional footnotes. These clues allow the readers to tie previous experience to the materials they are reading.

Word comprehension refers to knowledge of word meaning.

Delimitations

The scope of this study was delimited in several ways. First, geographically this study was restricted to Orange County in Central Florida, a large, fast growing school district with more than 100,000 students. Second, the subjects for the study were seventh grade middle school adolescents who have been identified as at risk for dropping out of school. Third, only subjects attending public middle schools were considered for the study.

Limitations

Since this study included only at-risk middle school students, the findings should not be generalized to

handicapped, nonhandicapped, elementary, or high school students. Moreover, the results of this study cannot be generalized to vocabulary terms in other content areas without replication. Further, caution should be exercised in extrapolating the results of this study to students who live outside of Orange County and who attend schools other than the public sector.

Summary

Dropouts are a major national problem confronting urban school districts. School officials recognize the burden placed on society by large numbers of students who lack necessary educational skills. Educators, however, are seeking a variety of methods to increase self-esteem and school success in hopes of encouraging at-risk students to remain in school.

The intent of this study was to contribute information regarding the effectiveness of teaching geography vocabulary to at-risk students through three different memory strategies: keyword mnemonics, contextual analysis, and rote free-study. Specifically, immediate acquisition and delayed recall were investigated for these teaching strategies of vocabulary terms. The results of this study should have direct and immediate implications for regular education teachers who teach vocabulary terms to at-risk students.

Chapter 2 contains a review of literature pertinent to this study. Chapter 3 includes the hypotheses, method and procedures of the study, and treatment of the data. Results of the study are presented in Chapter 4, and discussion, conclusions, and implications for instruction and future research make up the fifth, and final, chapter.

CHAPTER 2

REVIEW OF RELATED LITERATURE

The purpose of this chapter is to investigate, evaluate, and summarize existing relevant information related to memory techniques that pertain to keyword mnemonics, contextual analysis, rote free-study strategies, and the use of visual imagery. The problem addressed by the present research, the effects of memory strategy training on the performance of at-risk adolescents' vocabulary acquisition and retention, has not appeared in the literature, although several studies concerning the effect of memory strategy training on other populations have been reported. The available studies most closely related to the present research have been chosen for review and discussion. The inclusion criteria for research reviewed are stated first. Second, a historical summary of memory and, specifically, of the literature supporting the use of both the keyword mnemonic strategy with mildly disabled adolescents and the contextual analysis strategy with various populations is presented. Third, a description and a critique of research that experimentally compares the keyword mnemonic strategy and the contextual analysis strategy with other memory strategies is provided.

Inclusion Criteria

The following criteria were used to select the information reviewed.

1. The experimental question(s) of each study must include either the effectiveness of keyword mnemonic, contextual analysis, and/or rote free memory strategies.
2. The dependent variable of each study must include recall of factual information.
3. Each study must include a complete research report of data, including a description of subjects, methodology, and results.

Sources used for locating applicable information included card catalogs and computer systems at the University of Florida, University of Central Florida, and Rollins College libraries; Current Index of Journals in Education; Educational Resources Information Center; the interlibrary loan services; the reference sections of related articles, chapters, and books; and personal communication with other investigators who have conducted research using memory strategies or studied learners who are at-risk.

Background Information on Memory Strategies

The teaching of memory strategies has evolved since the days of ancient Greece and Rome (Minninger, 1984; Wittrock, 1986). Learning how to remember information was devoted to rhetoric, the art of public speaking. Learning how to memorize the sequence of points in speeches was an important

part of rhetoric because paper and pencil were not readily available. Teachers and orators used memory strategies derived from Aristotle's model of memory, which emphasized putting points in a linear sequence, with each point represented by an image involving an interaction with an easily retrievable familiar object.

Prior to Twentieth Century

Many of Plato's and Aristotle's ideas are still relevant today (Anderson & Bower, 1973; Weimer, 1973). Both philosophers formulated sophisticated theories about the acquisition of knowledge (Hett, 1964; Lamb, 1967). Aristotle divided memory into two parts: memory, a type of remembering common to all animals; and recall, a superior human action, involving a sense of time, deliberation, and the relation of a chain of experiences to a present experience (Minninger, 1984). Plato, Aristotle's teacher, described mechanics of memory by calling up a detailed picture of events and associations from a single item (e.g., a lyre making one think of its owner, a special town, and then friends).

Later in the 1800s, Hermann Ebbinghaus was one of the first people to systematically research memory processes. He studied how fast information could be acquired and how long information could be kept in memory. He invented strings of nonsense syllables and recited sequences of them aloud to test how many repeats were necessary before he could memorize them (Ebbinghaus, 1885/1913). He tested himself at the same

time every day under the same conditions, but varied all other factors such as the length of the lists or the time between memorization and recall. He discovered that he could remember much better first thing in the morning and concluded that fatigue affected memory.

Twentieth Century

The next important group of studies of memory strategies were conducted in the early part of the twentieth century by Sir Frederick Bartlett in England (Bartlett, 1932). He felt that Ebbinghaus' approach was artificial and designed experiments to investigate subjects' ability to use known information to facilitate recall by integrating new thoughts and patterns into the previously learned information. His subjects looked at pictures and read stories. They used personal associations and prior experiences to help recall specific attributes and facts about the material. Bartlett (1932) concluded from these studies that memory occurred by laying a new pattern of information over a similar old one. His studies lacked strict controls necessary to ensure a uniform basis of comparison, and at the time, many felt his work was too vague and complex (Minninger, 1984).

Two-System Theory

Before the 1950s, memory was thought of as one system. Then, a two-system theory became popular: a short-term memory for our immediate environment and a long-term memory for "facts" (e.g., language, history, math). During this

period, researchers discovered that even the ability to remember information for fifteen or twenty seconds depended on activities performed by the learner (Bransford, 1979). Peterson and Peterson (1959) investigated the rate of forgetting strings composed of three consonants; for example JHB on trial 1, TSR on trial 2. Students were required to count backwards by threes from a number they were given in order to prevent the use of a rehearsal strategy. The intervals between presentation of a particular letter string and the request for recall included three, six, nine, twelve, fifteen, and eighteen seconds. The results from Peterson and Peterson's strategy indicated that without rehearsal recall dropped as the retention interval increased from three to eighteen seconds.

Waugh and Norman (1965) also studied the effects of short-term memory while preventing rehearsal strategies. Waugh and Norman, however, presented people with additional items and told them not to rehearse. Their results are similar to those of Peterson and Peterson (1959). When rehearsal is prevented, short-term memory is influenced by the number of intervening items.

Multiprocess Memory Theory

Ellis (1970) adopted the multiprocess memory theory based on the theoretical conceptions proposed by Waugh and Norman (1965). This theory supports the belief that information or external stimulation is taken in by the

learner through the attention process. Next, this information goes directly to the primary memory, which is considered a limited storage system. This level of memory is only capable of holding small bits of information momentarily. Without further memory processing or with the passage of more than a few seconds, primary memory will be lost. Therefore, rehearsal strategies are necessary and are the next process in Ellis' model. The learner uses these rehearsal strategies to try and retain information that is in the process of being lost from any of the three memory systems--the primary memory, the secondary memory, or the tertiary memory. In Ellis' multiprocess memory theory, these rehearsal strategies are considered as the means for which information is transferred from one memory system to the next. This transfer of information makes retention of information possible.

Constraints on Short-Term Memory

In addition to Peterson and Peterson (1959), Waugh and Norman (1965), and Ellis (1970), other investigators have emphasized the constraints on memory strategies for short-term retention (Chase & Simon, 1973; DeGroot, 1965; Miller, 1956). These researchers all agreed that effectiveness of a memory strategy for short-term retention depended on the degree to which one used previous knowledge to encode materials into meaningful units. Other theorists (Atkinson & Shiffrin, 1968) postulated that there is a limit to the

amount of information that can be held in short-term memory and that a transfer of information from short-term storage to long-term storage is an important aspect of the memory and learning process. Atkinson and Shiffrin (1968) further classified the two dimensions of the memory system. The first categorization distinguished permanent, structural features of the memory system that included both the physical system and the processes that are invariant from one situation to another. The other dimension referred to the control processes that are modifiable by the individual and may vary from one task to the next. The use of a particular control process for remembering information in a given situation depends upon the type of instructions, the meaningfulness of the material, and the individual's learning history. In other words, the structural features include the basic memory stores and the control processes involved in any coding procedures, rehearsal operations, and categorization strategies. Other theorists and researchers have argued that automatic processes in cognition have some basic operating characteristics of the information processing system. These theorists support the belief that memory encoding includes fundamental aspects of experience.

Automatic Processes

Hasher and Zacks (1979) conducted studies to support the theory of the use of automatic processes in cognition and to specify the details of their operation. These authors

hypothesized that some automatic processes are inborn and therefore require no attentional resources. They claimed that frequency of occurrence, spatial location, and the order of events are automatically encoded into long-term memory and continually register in memory at an optimal level. Hasher and Zacks (1979) stated that six criteria must be jointly satisfied in order to make certain that a process, aspect, or attribute of experience is automatically encoded. According to these criteria, encoding of frequency, temporal order, and spatial location information should not be affected by intention, age, and simultaneously processing demands, or by practice and individual differences.

The frequency of occurrence of events has been the most studied aspect of the environment for its automaticity (Ellis & Palmer, 1988; Hasher & Zacks, 1979, 1984). Two other aspects of the environment, spatial location and temporal order information, were also thought to be encoded automatically, although they were not as thoroughly investigated as frequency of occurrence. Although Hasher and Zacks (1979) relied on several studies (Attneave, 1953; Howell, 1973) to support their automaticity theory for spatial location information, other researchers (Ellis, 1990, 1991; Naveh-Benjamin, 1987, 1988) revealed that the results of some tests of criteria for automaticity are ambiguous, whereas other criteria have not been studied at all.

Naveh-Benjamin (1987) conducted four experiments that examined five criteria for the automaticity of cognitive processes. Results showed that memory for spatial location information was influenced by intention, age of subjects, competing task loads, practice, strategy manipulations, and individual differences. This author's results contrasted Hasher and Zacks' (1979) theory that spatial location information is automatically encoded.

Ellis (1990, 1991) conducted research examining the effects of memory for spatial location and concluded that memory included both effortfully and automatically processed subtasks. Ellis' research did not support all components of Hasher and Zacks' theory, but the results of his experiments uphold the main idea of their position. Ellis' (1991) data suggested that memory for location is not consistent in tasks requiring memory for long series of location. Ellis (1991) stated that memory for a limited number of locations in such a series can be improved strategically and is facilitated by instruction, and that this augments the automatic memory component. He concluded that the remembering of locations of objects in the environment is predominantly an automatic process even though the Hasher and Zacks (1979) criteria for defining memory for spatial location as an automatic process were not met in his experiments.

Memory theories have evolved throughout the years. Early theorists divided memory into two parts based on the

capability of the brain, but a two-system theory did not emerge until the 1950s. Later, the memory system was further classified and included the transfer of information into different storage systems. Next, memory theorists focused on the use of automatic processes in cognition. Research that evolved from these theories based on the transfer of information from short-term storage to long-term storage and the existence or nonexistence of automatic processes has lead to numerous studies on devices, procedures, and operations that may improve memory.

Background Information on Mnemonic Strategies

One strategy that effectively incorporates what a student has already learned is mnemonic instruction. A mnemonic device can be defined as a strategy for organizing and/or encoding information through the creation and use of cognitive cueing structures (Bellezza, 1981). Mnemonic devices have been used for more than 2,000 years (Higbee, 1979), however, controlled studies of mnemonic effects were limited until 1975, when Atkinson published an experimental study of the "keyword" method for teaching Russian vocabulary. Atkinson's research initiated a renewed interest in mnemonic strategies. Organization for many mnemonic strategies usually involves a strong imagery component. Typically, imagery represents the to-be-remembered information by implying a sequence of symbolic transformations, which go from words to images, and then back

to words (Paivio, 1971). These mnemonic strategies have not only helped students to acquire unknown information, but have also given students a strategy for retrieving information. Mnemonic instructional procedures are taught to provide a retrieval link between stimulus and response information, thus, facilitating later recall (Mastropieri, Emerick, & Scruggs, 1988).

Researchers have established that pictures make more substantive events than do words (Bower, 1972; Pressley, 1977; Rohwer & Harris, 1975) because of the greater concreteness of pictures. Levin, Divine-Hawkins, Kerst, and Guttman (1974) studied fourth graders' acquisition of paired associates. They found that for 20% of the students the nature of the materials presented was critical on acquisition rates. That is, students functioned poorly when words were presented, but excelled when pictures were presented. Levin (1983) described a trio of assumptions (and associated corollaries) underlying the use of pictorial imagery strategies for school learning:

1. Pictures can substantially improve students' learning of school content.
 - 1a. Pictures should be used as school learning aids.
2. The degree of picture facilitation expected depends on the relationship between the particular learning task and the kind of pictures provided or generated.
 - 2a. Pictures that are directly related to the task content and component processes will be more effective than those that are not.
 - 2b. Pictures that transform task content into a more meaningfully coded form will be more effective than those that do not.

3. Picture effects can be expected to vary as a function of relevant student characteristics. (p. 214)

Levin (1983) further explained that the potentially valuable result of picture use and instruction was one of training learners to transfer from a reliance on externally provided cues to the skill of producing internally generated cues. Levin claimed that pictures are more concrete than words in that they provide learners with a closer approximation to their environments. For children's and adult's learning of unconnected materials, pictures have been superior to words, in tasks involving both recognition and recall memory (Levin, 1976). Various types of illustrations have been incorporated into mnemonic methods. One alternative mnemonic procedure that incorporates mental as well as pictorial images for recall is the peg-word mnemonic procedure.

Peg-Word Theory

The peg-word theory is one of the oldest and most influential mnemonic processes described in the Roman books on rhetoric. Based on this theory, Paivio (1971) proposed that the stimulus member of a pair functions as a "peg" to which its associate is connected during learning, and from which it can be retrieved during recall. According to Paivio, the more the concrete the stimulus, the more "solid" it is as a conceptual peg, and the better the recall. Concreteness can be defined in terms of its "image-arousing

value," the speed and ease with which the word arouses some mental image (Bower, 1972). On recall trials, then, the image-arousing value of the stimulus is critical, because it "reintegrates the compound image from which the response component can be retrieved and recoded as a word" (Paivio, 1971, p. 248). Paivio (1971) developed the "conceptual peg hypothesis" based on studies of paired-associate tasks.

Pair-Associate Tasks

Bower (1972), Levin (1976), and Rohwer (1966) have concluded that when two unrelated nouns are paired, both the verbal and imaginary elaborations that relate the two nouns in a meaningful experience are more powerful than elaborations that maintain the separate characters of the two items. Pictures, as applied to most paired-associate tasks, can either be improved, provided by an experimenter or instructor, or induced, generated by a subject. Bower (1972) attempted to create a high memory load for his college-aged subjects by presenting them with five 20-pair lists. Imagery subjects were instructed to generate interactions of the associated noun items, whereas control subjects were given an equivalent amount of time to study the lists. Results, based on the recall of the 100 pairs, showed that imagery subjects remembered twice the amount of information than did control subjects on both short-term and long-term assessments.

Additional Memory Factors

Some researchers have identified specific factors that affect a subject's ability to benefit from both visual and verbal memory strategies. Levin (1976) addressed the variable of age. He suggested that students at all age levels possess a wide range of cognitive-developmental abilities. He maintained that this results in great performance variability. Age, therefore, interacts with other variables such as socioeconomic status, intelligence, and learning styles in determining performance for the learning of paired associates for words.

As previously mentioned, an additional factor in the success of remembering a word is its concreteness. Therefore, abstract information must be encoded into a concrete word or picture symbol, so that it can fit into some organizational scheme (Bellezza, 1981; Bugelski, 1970; Paivio, 1968). According to Bower (1972), abstract words presumably evoke little or no imagery directly, but may do so indirectly through associated words, such as heart for "love," or church for "religion."

Semantic encoding procedures have made abstract words and concepts more memorable in paired associate learning tasks using unconnected elements. For example, Paivio (1968) studied paired associates using 2 ten-item lists of concrete nouns. The purpose of his investigation was to observe the effects of imagery or no-imagery conditions. For List 1,

subjects were presented the to-be-recalled nouns preceded by the numbers 1 to 10. They were not taught a mnemonic strategy. The numbers were then presented in a random order, and subjects were directed to recall the corresponding items. For List 2, subjects were assigned to an imagery instruction or no-imagery instruction condition and were taught either a concrete (e.g., one-bun; two-shoe; etc.) or an abstract (e.g., one-fun; two-true; etc.) pegword mnemonic. Subjects in the imagery group were instructed to use mental images to relate the pegword rhymes with the to-be-remembered items. For example, if the to-be-associated item with one was pencil, students in the concrete pegword group would be asked to construct an interactive mental picture involving the pegword, bun, and the to-be-associated item, pencil. A likely image would be that of a pencil inside a hot dog bun. Students in the abstract pegword group, on the other hand, would need to form a mental image of the pegword, fun, interacting with the pencil. Because the abstract term, fun, cannot be directly represented in a picture, the students had to encode fun into a concrete referent in order to put it in a scene with pencil. Subjects who were not given imagery instruction were told to recall the list by saying to themselves the rhyming words, along with the to-be-remembered item (e.g., "one-bun-pencil" or "one-fun-pencil").

Paivio found the recall was better for the subjects in the mnemonic condition (List 2) than for subjects studying

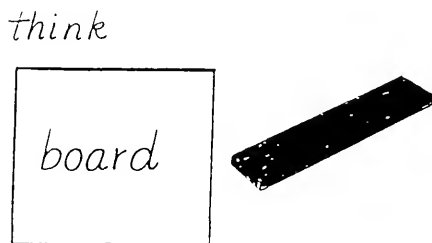
the control list (List 1). Subjects who received imagery instructions also had better recall than those who received no-imagery instructions. The method appeared to be equally facilitative for both concrete and abstract pegwords. Paivio concluded that when the subject is presented with abstract items, semantic encoding operations transform this information into concrete, familiar illustrations or images. Another mnemonic strategy that has been successfully utilized for rendering abstract and unfamiliar terms to more concrete has been the mnemonic keyword method (Levin & Pressley, 1985), which is a phonetically based operation.

Keyword Mnemonic Strategies

In 1975, Richard Atkinson of Stanford University was one of the first researchers to study the use of mnemonic devices in educational settings (Higbee, 1979). Atkinson and Raugh (1975) used college students as subjects to demonstrate the benefits of a mnemonic imagery strategy for learning foreign language vocabulary. This mnemonic technique, the keyword method, is a two-stage process connecting an auditory-perceptual link to an imagery link and has been beneficial as a strategy to enhance the acquisition of native-language vocabulary (Levin & Pressley, 1985). Basically, the keyword method attempts to enhance learning and memory by facilitating the encoding of information so that the information can be easily retrieved. The vocabulary term to be taught is first reconstructed to a concrete, previously learned, acoustically similar proxy, or "key word."

Next, the reconstructed keyword is shown in an interactive picture with its response. Effective conversions assimilate the "three Rs" of associative mnemonic techniques: (stimulus) recoding, (semantic) relating, and (systematic) retrieving (Levin, 1983).

First, during the recoding component a learner transforms an unfamiliar term into a concrete, familiar word that sounds like a salient part of the new vocabulary word. For example, a new geography term "fjord" could be transformed into the keyword "board" (see Figure 1).



"fjord" transformed into the keyword "board"

Figure 1. Recording Component

Second, the learner applies a relating component, where the keyword becomes linked to a desired response through an interactive scene. For "fjord," a narrow arm of the sea bordered by steep hills, a board would be drawn connecting two steep hills on each side of a narrow strip of water (see Figure 2).

fjord

*a narrow
arm of the
sea bordered
by steep hills*



"fjord," a narrow arm of the sea bordered by steep hills; a board connects two steep hills on each side of a narrow strip of water.

Figure 2. Relating Component.

Lastly, the third component of the method provides the student with a systematic means of retrieving the meaning of the geography term. In the present example, to retrieve the meaning of "fjord," the student would be led directly from the stimulus (fjord) to the keyword (board) to the interactive picture (a board connecting two steep hills over a narrow body of water) to the correct response (a narrow arm of the sea bordered by steep hills) (see Figure 3).

Levin (1981b) described several psychological principles of the keyword method: (a) meaningful stimuli are more reliably encoded than are nonmeaningful stimuli; (b) interacting items are more reliably associated than noninteracting items; (c) the greater the similarity between the two stimuli, the more reliably one will evoke the other;

fjord



"fjord"--student was led from the stimulus (fjord) to the keyword (board) to the interactive picture (a board connecting two steep hills over a narrow body of water) to the correct response (a narrow arm of the sea bordered by steep hills).

Figure 3. Retrieving Component.

and (d) thematic interactions are reliably retrieved from appropriate cues.

Some researchers who have examined the effect of keyword mnemonic instruction have compared mnemonic keyword picture conditions with no-picture control conditions (Pressley & Levin, 1978), making it difficult to determine whether it was the specific use of the mnemonic keyword picture or the utilization of pictures in general that was responsible for the increased acquisition of terms to the mnemonic keyword conditions. In one study, however, Levin, McCormick, Miller, Berry, and Pressley (1982) presented subjects with mnemonic keyword pictures and compared these subjects to subjects who were provided with nonmnemonic pictures. The subjects in the mnemonic keyword picture condition outperformed the subjects

shown nonkeyword pictures. The subjects in this study were fourth grade students who were presented difficult English vocabulary words. The subjects who were provided with nonkeyword pictures relating each word with its contextual definition performed at the same level as the no-picture control condition. In contrast, the subjects provided with mnemonic keyword pictures, interacting the keyword to the vocabulary word's definition, substantially outperformed subjects in the control condition. These mnemonic keyword pictures displayed objects or events that were not mentioned in the text and that had little or no relation to the conceptual content of the material being learned (Bellezza, 1981).

According to Levin (1983), the representation, organization, and interpretation functions of pictures merely reiterate, consolidate, and symbolize, respectively, the information presented. A truly mnemonic picture represents a physical recoding of the textual information and must implicate the transformation function. Mnemonic pictures, therefore, must contain different information from that in the text, because the illustrations or images have provided a physical recoding of the to-be-remembered information. Mnemonic instruction has been successfully used with both educationally disabled and nonhandicapped populations in a variety of content areas (Levin, 1983; Levin, McCormick, Miller, Berry, & Pressley, 1982; Levin, Pressley, McCormick, Miller, & Shriberg, 1979; Mastropieri, Scruggs, & Levin, 1985a; Mastropieri,

Scruggs, & Levin, 1985b). This instruction has been used in classes such as foreign language, English, science, and geography. Mnemonic instruction has been particularly successful in helping mildly disabled students learn an effective and efficient way to remember unfamiliar definitions (Scruggs & Mastropieri, 1992). If mildly disabled students have been successful at acquiring specific strategies to learn unfamiliar definitions, then at-risk students may benefit from similar strategy training to help them remember definitions of unfamiliar terms.

Keyword Mnemonics with Students with Mild Disabilities

The effects of keyword mnemonic instruction for students with mild disabilities, as represented in the literature since 1986, are reported and comprise a total of eight studies. The majority of the studies were conducted with adolescents who had learning disabilities (LD). Exceptions to this population included seven students that attended a varying exceptionalities (VE) class who were classified as emotionally handicapped (EH) (King-Sears, Mercer, & Sindelar, 1992) and one mildly developmentally delayed student who was included in a resource class with learning disabled students (Scruggs & Mastropieri, 1992). Another study was a pilot study conducted with at-risk adolescents (Fox, King, & Evans, 1987). One of the studies contained an additional experiment (McLoone, Scruggs, Mastropieri, & Zucker, 1986); thus, a total of nine studies were analyzed.

Other keyword mnemonic research exists with the learning disabled population, but these eight studies are representative of the research evaluating the effectiveness of mnemonic instruction individually administered, taught to small groups of 2 to 4 students, and taught to larger groups of 10 to 18 students per class. Most of the research concerning keyword mnemonic instruction with mildly disabled students has focused on the acquisition and retention of vocabulary terms or specific concepts, particularly those in social studies and science curriculum.

The evolution of the research documenting the effectiveness of the keyword mnemonic strategy for learning disabled students has followed a progression of replications and extensions of previous findings: one-to-one teaching and testing situations using trained experimenters (Mastropieri, Scruggs, Bakken, & Brigham, 1992; Mastropieri, Scruggs, & Fulk, 1990; McLoone, Scruggs, Mastropieri, & Zucker, 1986; Scruggs & Mastropieri, 1992; Veit, Scruggs, & Mastropieri, 1986); randomized subjects to treatment conditions (Mastropieri, Scruggs, & Fulk, 1990; McLoone, Scruggs, Mastropieri, & Zucker, 1986); small groups randomized to treatment conditions (Veit, Scruggs, & Mastropieri, 1986); brief intensive experimental sessions (Mastropieri, Scruggs, & Fulk, 1990; McLoone, Scruggs, Mastropieri, & Zucker, 1986); highly unfamiliar concrete materials to classroom mnemonic instruction (Fox, King, & Evans, 1987; King-Sears, Mercer, &

Sindelar, 1992; Mastropieri, Scruggs, Bakken, & Brigham, 1992; Scruggs & Mastropieri, 1989; Scruggs & Mastropieri, 1992; Veit, Scruggs, & Mastropieri, 1986); existing classrooms counterbalanced across treatment conditions (Mastropieri, Scruggs, Bakken, & Brigham, 1992; Scruggs & Mastropieri, 1989; Scruggs & Mastropieri, 1992); situations involving existing classroom teachers (King-Sears, Mercer, & Sindelar, 1992; Scruggs & Mastropieri, 1989); and using existing curriculum for training purposes (Mastropieri, Scruggs, Bakken, & Brigham, 1992; Scruggs & Mastropieri, 1989; Scruggs & Mastropieri, 1992; Veit, Scruggs, & Mastropieri, 1986). A description of each of these experiments is included in the following review and these experiments are critiqued in terms of their research designs, subject characteristics, experimental procedures, materials, instructional medium, content taught, and measurement methods. Table 2-1 lists the investigators, subjects, interventions, and content taught to the subjects with mild disabilities. Study results are reported and summarized.

Research Design and Description of Conditions

A group research design was used in all reviewed studies to determine the effectiveness of the keyword mnemonic strategy on mildly disabled students' recall of information. Subjects were either randomly assigned to treatment conditions, in groups that were randomly assigned to a

Table 2-1

Review of Keyword Mnemonic Vocabulary Studies with Mildly Handicapped Subjects

Investigators	Subjects	Interventions	Content
King-Sears, Mercer, & Sindelar (1992)	37 sixth, seventh, and eighth graders -30 SLD -7 EH	Imposed Keyword Mnemonics -Teacher provided -Systematic teaching Induced Keyword Mnemonics -Student provided -Systematic teaching Systematic Teaching (direct instruction)	Four vocabulary sets 12 science terms per week for 4 weeks (48 terms)
<p>Results: Subjects in the imposed keyword mnemonic groups acquired and remembered more definitions than subjects in the systematic teaching group. Subjects in the imposed keyword mnemonic group consistently, and sometimes significantly, outperformed subjects in the other two groups. There were no significant treatment effects 3 weeks following instructions.</p>			
McLoone, Scruggs, Mastropieri, & Zucker (1986)	60 SLD seventh and eighth graders from three junior high schools	Keyword Mnemonics -Teacher provided Direct Rehearsal Individually Taught	Two vocabulary sets: 1. 16 low frequency English terms 2. 16 Italian vocabulary terms
Experiment 1			
<p>Results: The teacher provided keyword mnemonic strategy condition subjects produced greater recall of vocabulary definitions than the directed rehearsal strategy condition subjects.</p>			

Table 2-1--continued

Investigators	Subjects	Interventions	Content
McLoone, Scruggs, Mastropieri, & Zucker (1986)	60 SLD seventh and eighth graders from three junior high schools	Keyword Mnemonics -Student generated -transfer task -Direct rehearsal -rote free-study -transfer task	13 vocabulary terms 13 vocabulary terms
Experiment 2			
Results:	In the transfer, student generated conditions, subjects trained in the mnemonic condition performed significantly better than subjects trained in the directed rehearsal condition.		
Veit, Scruggs, & Mastropieri (1986)	64 seventh, eighth, and ninth graders -"Reading Disabled" -one junior high	Pegword Mnemonic -Picture -Teacher provided Direct Questioning with pictures Small group instruction 2-4 students	3 facts of 16 dinosaurs: 1. name (Greek root) 2. attribute 3. reason extinct
Results:	Mnemonically instructed subjects scored statistically higher than direct questioning condition subjects on all immediate and one day delayed recall tests, except the vocabulary test (recall of meaning for word parts taken from dinosaur names).		
Fox, King, & Evans (1987)	16 at-risk sixth, seventh, and eighth grade students One middle school	Keyword Mnemonic Direct Instruction	35 geography terms -from 7th grade Geography text
Results:	A t-test for matched pairs revealed no significant difference between the two treatment groups in recall and matching of terms and their definitions. However, both treatment conditions did produce significant differences between the pretest and posttest.		

Table 2-1-continued

Investigators	Subjects	Interventions	Content
Scruggs & Mastropieri (1989)	26 seventh and eighth graders -deficient in study skills -inner city -one junior high	Keyword Mnemonics -Teacher provided Traditional Instruction -Teacher provided	4 U.S. History 1-World War I 2-Great Depression 3-Roaring Twenties 4-Seeds of Conflict
Results: Mnemonically instructed subjects scored statistically higher than traditional condition subjects. Overall, students earned an average grade of "B" under mnemonic instruction, and an average grade of "D+" under traditional instruction.			
Mastropieri, Scruggs & Fulk (1990)	25 SLD sixth, seventh, and eighth graders -resource room in one middle school	Keyword Mnemonics -Teacher provided Direct Rehearsal (individually taught)	16 English vocabulary terms -concrete -abstract
Results: SLD subjects in the keyword mnemonic condition performed better than SLD subjects in the direct rehearsal condition on two assessment measures. The first assessment required subjects to verbally state the definitions of the terms. The second assessment required subjects to state the term when given a novel instance of the word. Subjects performed better recalling concrete terms than abstract terms.			
Scruggs & Mastropieri (1992)	20 sixth, seventh, and eighth graders -19 SLD -1 EMH 2 self-contained classes at one middle school	Keyword Mnemonic -Picture-Tchr Provided Traditional Instruction -Free-study Mnemonic Transfer -Student generated (Group Instruction - 10 students)	4 -Science chapters' content a. vertebrate animals b. invertebrate animals c. earth history d. geology
Results: In each classroom, subjects performance was substantially higher under mnemonic instruction compared with the traditional free-study conditions.			

Table 2-1--continued

Investigators	Subjects	Interventions	Content
Mastropieri, Scruggs, Bakken, & Brigham (1992)	29 SLD - low SES seventh and eighth graders -26 self-contained -3 resource room	Keyword Mnemonic Pictorial-Teacher Provided Traditional Pictorial -teacher provided -free study (group taught)	40 states and their capitals

Results: The SLD students receiving keyword mnemonic instructional methods produced statistically significant differences in both forward and backward recall when compared to the same instructional procedures excluding the keyword mnemonic strategies.

treatment condition, or treatment order was counterbalanced across classrooms.

All nine of the experiments compared the keyword mnemonic strategy to traditional teaching control groups such as directed rehearsal. Veit, Scruggs, and Mastropieri (1986) compared the keyword mnemonic to a control group taught the same information using the principles of direct instruction, including teacher-directed questioning, choral group responding, fast instructional pacing, and cumulative review. The mean number of correct definitions for each group was compared and analyzed using a t-test.

McLoone, Scruggs, Mastropieri, and Zucker (1986) also compared keyword mnemonic instruction to a direct instruction control group. This direct rehearsal condition incorporated techniques from direct instruction procedures (e.g., teacher states the definitions and the students repeat the definition back at a rapid pace). Immediately following Experiment 1, comparing learning disabled adolescents' recall of unfamiliar vocabulary words using either keyword mnemonic strategies or directed rehearsal strategies, the same subjects participated in an extension study, Experiment 2. In the second experiment, the subjects were trained to transfer the keyword method or rehearsal method to another, similar list of vocabulary words using their respective strategies learned in Experiment 1 independently. This generalization skill was called a transfer task. The researchers were interested in

examining if subjects, under some circumstances, could learn to generate their own keywords and interactive images. Again, mean percentage of correct definitions was compared using t-tests.

Another study examining aspects of keyword mnemonic instruction with mildly disabled students was conducted by Mastropieri, Scruggs, and Fulk (1990). Three additional research questions were examined concerning the keyword mnemonic strategy: (a) could LD students benefit from keyword vocabulary instruction when vocabulary was not selected for keyword "obviousness?" (b) could LD students learn abstract as well as concrete terms with the keyword strategy? and (c) does mnemonic instruction inhibit comprehension? A direct rehearsal condition was used as a control that included stating the definitions, having the students repeat the definitions, and providing for drill and practice of the definitions. A two-condition (keyword vs. directed rehearsal) by two-item (abstract vs. concrete) analysis of variance (2 X 2 ANOVA), with repeated measures on the item type variable (production recall task and comprehension task) was employed.

King-Sears, Mercer, and Sindelar (1992) examined the independent use of the keyword mnemonic method by students with mild disabilities. These researchers compared a systematic teaching method, an imposed keyword method, and an induced keyword method. The systematic teaching method

included a combination of effective teaching techniques derived from direct instruction procedures. The imposed keyword method included the provision of a keyword and an interactive illustration. The induced keyword condition required students to devise their own keywords and interactive images. This third condition was important to examine due to the time and cost spent in developing materials for teacher-provided keyword mnemonic instruction. Students' existing varying exceptionalities (VE) teachers randomly assigned to one of the three treatment conditions. A repeated measures ANCOVA was used to analyze the data with IQ as the covariate.

Fox, King, and Evans (1987) investigated the keyword mnemonic strategy with at-risk adolescents to determine whether or not similar benefits would occur with this population as did for LD adolescents while learning unfamiliar vocabulary terms. The keyword mnemonic strategy condition was compared to a direct instruction condition. Students were matched based on the results of two pretests and randomly assigned to one of the treatment groups. A t-test for matched pairs was calculated to determine whether there was a significant difference in posttest results between the two treatment conditions.

Scruggs and Mastropieri (1989) conducted one of the first studies evaluating learning disabled students' use of keyword mnemonic strategies to learn existing material in an

assigned U.S. history textbook by their assigned teacher. Experimenters employed a within-subjects design across classrooms. Each classroom received instruction on four chapters: one chapter of mnemonic instruction; one chapter of traditional, textbook-based instruction; another chapter of mnemonic instruction; and a final chapter of traditional instruction. The means of the two groups' test scores were compared by a t-test for correlated samples.

An additional study that extended the application of the keyword mnemonic strategy with students with mild disabilities was conducted by Scruggs and Mastropieri (1992). The authors of this study also evaluated actual classroom curricular materials, four chapters from a science text, with respect to the keyword mnemonic strategy. One purpose of this investigation was to investigate the extent to which mildly disabled students could transfer complex mnemonic strategies to science context and evaluate any negative effects. A within-subjects design, in which treatment order was counterbalanced across classrooms, was used to compare the keyword mnemonic strategy to a traditional teaching strategy condition. Test score data were analyzed by a 2 X 2 (Classroom X Instructional Unit) analysis of variance with repeated measures on the instructional unit variable.

Mastropieri, Scruggs, Bakken, and Brigham (1992) also used a counterbalance design across classrooms to evaluate the effectiveness of keyword mnemonic strategy for mildly

disabled students' acquisition of 40 states and their capitals. Subjects in each of two self-contained LD classrooms received mnemonic and traditional instruction on different alternating weeks. Another issue these researchers examined was forward versus backward recall of mnemonically instructed information. A two condition (mnemonic vs. traditional) by two response (state vs. capital) analysis of variance procedure was used to analyze subjects' performance.

Subject Characteristics

In eight of the reviewed studies, all except for one student had been classified as Specific Learning Disabilities (SLD) according to federal, state, and local criteria. One student had been classified as Educable Mentally Handicapped (EMH), but attended an SLD resource class (Scruggs & Mastropieri, 1992). Another study included seven students classified as Emotionally Handicapped (EH) that attended VE classrooms with other SLD students (King-Sears et al., 1992). Only one study included the use of keyword mnemonics with at-risk adolescents (Fox, King, & Evans, 1987). The number of subjects in the reviewed studies ranged from 16 (Fox, King, & Evans) to 64 (Veit, Scruggs, & Mastropieri, 1986). All subjects attended public middle or junior high school. Sixth, seventh, and eighth graders participated in the studies conducted by Veit et al. (1986), Mastropieri et al. (1990), and Scruggs & Mastropieri (1992). The subjects in the Fox et al. (1987) study attended a special summer program

and were incoming seventh graders, incoming eighth graders, and incoming ninth graders. Seventh and eighth graders participated in the remaining five studies. Schools ranged from inner-city to suburban to rural.

Measurement Methods

All studies reviewed used posttest data to determine the effectiveness of the keyword mnemonic strategy with mildly disabled adolescents. Many scores and percentages of correct responses were reported in all investigations. An independent t-test was used when two interventions were compared to determine the statistical significance between the scores. Two studies used a 2 X 2 ANOVA to determine main effects. One study used an ANCOVA with IQ as the covariate. Additional tests were also used such as Mann-Whitney U, a nonparametric test and the Pearson r to help examine the correlation between strategy usage and student performance.

All studies reviewed included dependent measure designed to examine acquisition of factual information. Two investigations also measured strategy usage (Mastropieri, Scruggs, Bakken, & Brigham, 1992; Scruggs & Mastropieri, 1992). These experimenters also surveyed students asking them to rate the different instructional conditions with respect to (a) how much they enjoyed the instruction, (b) how much they had learned, (c) how hard they had tried, and (d) how much they would like to use the method again. Mastropieri, Scruggs, and Fulk (1990) assessed subjects'

knowledge of vocabulary definitions using a matching format as well as an orally produced definition of each targeted vocabulary word. Scruggs and Mastropieri (1989) and King-Sears, Mercer, and Sindelar (1992) were the only researchers to evaluate the teacher's perception of the appropriateness of each type of instructional material in each condition.

Most measurement methods utilized only verbal responses. Experimenters read the questions and wrote student responses verbatim. Only three studies included written responses (Fox, King, & Evans, 1987; King-Sears et al., 1992; Veit et al., 1986) with the exception of the use of a multiple-choice test by Scruggs and Mastropieri (1989), and Fox, King, and Evans (1987), and King-Sears, Mercer, and Sindelar (1992). The at-risk subjects in the Fox et al. (1987) study both read and wrote their own answers. Veit et al. (1986) had the experimenters read the questions, but the students wrote their responses. King-Sears et al. (1992) required subjects to read the terms and write the definitions from memory (production) first, then required subjects to match definitions to terms (recall). These experimenters also incorporated two means of scoring, strict and loose. Mastropieri et al. (1990) also used strict scoring for complete responses and gave one-half point for partial answers. Scorers using the strict scoring procedure gave one point to a response if it was clear and independently correct. When using the loose scoring procedure, scorers

allowed credit for items that had any part of the correct response given. These two scores yielded a conditional probability score that was computed on the probability of the student correctly applying a vocabulary word part that had not been correctly answered. Two independent scorers unaware of instructional conditions scored responses in all of the studies to establish interscorer reliability.

Experimental Procedures

The treatment conditions ranged from 1 day (Mastropieri, Scruggs, & Fulk, 1990; McLoone, Scruggs, Mastropieri, & Zucker, 1986) to 8 weeks (Scruggs & Mastropieri, 1989). The total instructional time for one session ranged from 15 minutes (King-Sears et al., 1992; Mastropieri, Scruggs, & Fulk, 1990; Veit, Scruggs, & Mastropieri, 1986) to 50 minutes (Mastropieri et al., 1992; Scruggs & Mastropieri, 1989, 1992). McLoone et al. (1986) conducted her study in one 25 minute session. All studies kept the amount of time in treatment conditions equivalent except for Mastropieri et al. (1992). These experimenters utilized a counterbalance design across two classrooms. One classroom had three mnemonic and two traditional weeks of instruction, while the other had two mnemonic and three traditional weeks of instruction. Scores of all subjects were converted to percentages due to the number of test items not being equivalent across classrooms.

Materials. The materials used in five of the keyword conditions were cards (e.g., 5" X 5", 8-1/2" X 11") that

contained the vocabulary term, its keyword, definition, and an interactive illustration of the keyword and the term's definition. The remaining three studies included similar information, but used overhead transparencies. The materials in all the control conditions were identical materials to that of the keyword condition with the exception of the keyword strategic information.

Instructional medium. Experimenters conducting the studies were trained in the specific strategies and most were certified teachers but only two studies utilized the subjects' assigned classroom teacher to provide the instruction (King-Sears et al., 1992; Scruggs & Mastropieri, 1989). Subjects were taught and assessed on an individual basis in two of the studies (Mastropieri, Scruggs, & Fulk, 1990; McLoone et al., 1986). Veit, Scruggs, and Mastropieri (1986) delivered instruction to small groups of two to four students by one of two female experimenters. Mastropieri et al. (1992) and Fox et al. (1987) conducted training sessions by one male or one female graduate student who were certified teachers. The regularly assigned special education teachers remained present during instruction in all the studies incorporating classroom implementation. The instructors in the study by Scruggs and Mastropieri (1992) were project staff from Purdue University who were also certified special education teachers.

Experimental constants. Attempts to keep the instructional conditions constant throughout the investigation phases were reported in all reviewed studies. All studies included prepared scripts and activities that were either timed with a stopwatch or pacing cassette tape (Fox, King, & Evans, 1987; King-Sears et al., 1992; Mastropieri, Scruggs, & Fulk, 1990; McLoone et al., 1986) or videotaped (Mastropieri et al. 1992; Scruggs & Mastropieri, 1992; Veit et al., 1986) to ensure standardization of experimental procedures. The instructors in all of the studies employed the principles of effective instruction (e.g., daily review, statement of instructional objective, guided practice, rapid paced questioning, corrective feedback). Assessment procedures for all conditions within a study were also consistent.

Results

Experimenters throughout the evolution of keyword mnemonic techniques with mildly disabled students from individual-based investigations with experimenter-developed tasks, into larger-scaled, classroom-based investigations using existing curricular materials and teachers have reported that mnemonically instructed students outperformed control students on recall of factual information. Investigators in eight of the reported studies found that mnemonic instruction resulted in substantial immediate and sometimes delayed recall gains over more traditional teacher-

led procedures. Only one investigation did not reveal significant recall differences in favor of the keyword strategy (Fox, King, & Evans, 1987). Even though no statistically significant differences were found between the keyword mnemonic condition and the direct instruction condition, students in both conditions did significantly improve their recall of targeted definitions on the pretest and posttest measures. Six studies (Fox, King, & Evans, 1987; King-Sears et al., 1992; Mastropieri, Scruggs, & Fulk, 1990; McLoone et al., 1986; Veit, Scruggs, & Mastropieri, 1986) compared keyword mnemonics to direct rehearsal components of instruction. Results from this research are consistently in favor of the keyword mnemonic condition with the exception of Fox et al. (1987) who found no significant differences between the treatment conditions. The remaining three studies (Mastropieri et al., 1992; Scruggs & Mastropieri, 1989; Scruggs & Mastropieri, 1992) compared keyword mnemonics to traditional instructional components that also included direct rehearsal strategies. Again, these researchers reported keyword mnemonic conditions significantly more effective for facilitating the factual recall of mildly disabled adolescents than traditional teaching conditions.

The results presented in these studies are conclusive of studies conducted with mildly disabled adolescents examining the effectiveness of keyword mnemonics. Although the keyword

mnemonic strategy has been proven effective for mildly disabled adolescents, studies on the effectiveness of this strategy with at-risk adolescents are limited. Further research is needed on the use of keyword mnemonic strategies instructed by the regularly assigned teacher with mildly disabled students. Furthermore, research is needed to determine the effectiveness of memory strategy training for at risk-adolescents.

The keyword method has been compared both to control conditions in which no specific instruction was given and to variations of the learning from context method. Sternberg, Powell, and Kaye (1983) found the outcome of these studies supported the keyword method as being "at least as effective as, and usually more effective than, the alternative methods against which it. . . (was) compared (to)." (p. 126). Other researchers, however, have found the keyword mnemonic strategy to produce nearly equivalent retention scores when compared to conditions such as the contextual analysis.

Background Information on Contextual Analysis

Johnson and Pearson (1978) defined contextual analysis and the use of context clues as terms that refer to a reader's attempt to understand the intended meaning of a word by scrutinizing surrounding context. In essence, using context clues means educated guessing. With contextual analysis the focus shifts from the individual word to other words, the structure of the sentence and other features that

can help pinpoint the meaning of the unfamiliar word. A critical distinction between mnemonic approaches to vocabulary learning and contextual approaches is that mnemonic approaches focus on remembering strategies while contextual approaches focus on inferring the meaning from internal and external contextual cues (Jenkins & Dixon, 1984). Although there is some debate about the extent to which students acquire word meanings from encountering words in context (Jenkins, Stein, & Wysocki, 1984; McDaniel & Pressley, 1989; Pressley, Levin, & Miller, 1982), many reading theorists purport that vocabulary words should be learned in contexts (Gipe, 1979; Johnson & Pearson, 1978; Otto & Smith, 1978) that can be synthesized to prior knowledge and incorporated by a schema (Carr & Wixson, 1986; Johnson & Johnson, 1986; Nelson-Herber, 1986).

Sternberg and Powell (1983) have proposed that learning from context involves three basic processes: knowledge-acquisition processes, contextual cues, and moderating variables. The authors proposed three processes of knowledge acquisition. The first process, selective encoding, involved separating relevant from irrelevant information for the purposes of formulating a definition. The second process, selective combination, involved combining relevant cues into a workable definition. The third process, selective comparison, involved taking new information about a word and relating it to old information already stored in memory.

According to Sternberg and Powell's theory (1983) the three processes of selective encoding, selective combination, and selective comparison operated together in a stable set of cues provided by the context in which the new words occur. Sternberg and Powell (1983) described eight context cues:

1. Temporal cues: cues regarding the duration or frequency of X (the unknown word), or when X can occur.
2. Spatial cues: cues regarding the location of X, or possible locations in which X can sometimes be found.
3. Value cues: cues regarding the worth or desirability of X, or the kinds of effects X arouses.
4. Stative descriptive cues: cues regarding properties of X (such as size, shape, color, etc.).
5. Functional descriptive cues: cues regarding possible purposes of X, actions performed, or potential uses of X.
6. Casual/Enablement cues: cues regarding possible causes of or enabling conditions for X.
7. Class membership cues: cues regarding one or more classes to which X belongs, or other members of one or more classes of which X is a member.
8. Equivalence cues: cues regarding the meaning of X, or contrasts to the meaning of X.

The moderating variables interact with knowledge-acquisition processes and these context cues. These variables make it either easier or harder to apply the

processes to the cues according to Sternberg and Powell (1983). The moderating variables include the number of occurrences of the unknown word, the variability of contexts in which multiple occurrences of the unknown word appear, the importance of the unknown word to understanding the context in which it is embedded, the helpfulness of surrounding context in understanding the meaning of the unknown word, the density of unknown words, and the usefulness of previously known information in cue utilization.

Sternberg and Powell (1983) first tested their theory by asking 123 high school students to read 32 passages of approximately 125 words in length that contained embedded within them from one to four extremely low-frequency words. Thirty-seven of the words (all nouns) were used in the passages; each target word appeared from one to four times, resulting in 71 different presentations altogether. The students' task was to define each of the low-frequency words within each passage. The qualities of definitions were rated independently by three trained raters. An average of the three ratings was used as a definition-goodness score for each word defined for each subject. These averages were then averaged over subjects to obtain a mean goodness-of-definition rating for each word. The main independent variables were ratings of the number or strength of the occurrences of contextual cues and moderating variables with respect to their roles in helping in the understanding of the

meaning of each low-frequency word in the passage. Sternberg and Powell (1983) concluded that the contextual cues and moderating variables proposed by their subtheories provided good prediction of the goodness-of-definition data. All correlations between predicted and observed goodness ratings differed significantly from zero (.92 to .77). The data, although limited, were consistent with the notion of the proposed theory.

Factors Affecting Contextual Analysis Research

Other researchers have provided evidence that inconsiderate contexts also prevent context clue instruction from being as effective as it might be (Graves, 1987). Carroll and Drum (1983) examined five content area texts (American literature, English, government, biology, and chemistry) and found that definitions of target words generated by students after reading the text varied as the contexts in which the words were embedded varied. For example, "The setting of a story- the specific time and place of the events - is rarely a dominant element" generated high scoring responses for the target word setting. On the other hand, "setting is stressed in . . . that fiction that concentrates on a specific era" produced a wide variety of definitions for the target word era.

Konopak (1986) found similar results when secondary students read passages on the same topics from different physics texts. While one text provided reasonably clear

definitional information, the second text presented the information in an informed style, such as analogies to everyday events. For example, in the informed text, kinetic and potential energy were described as players and reserves; the players "tear around the field" while the reserves "wait to be given a chance to move off." While this is an interesting comparison, a precise definition was not given.

Vacca and Vacca (1986) emphasized the teacher's role in helping students use context effectively in deriving word meanings. Furthermore, Sternberg (1987) elaborated that in typical contextual training programs, including those used in experimental comparisons to other methods of vocabulary teaching, the learning-from-context method consisted of presenting words embedded in a series of sentences, either with or without prior definitions. But if subjects do not know the processes, cues, and moderating variables that can be used for contextual learning, they will not benefit optimally from such instruction. In other words, subjects have to learn how to learn from context before they actually can learn from it. A vocabulary training program that uses learning from context is incomplete if it fails to provide instruction in how to use the context (Sternberg et al., 1983). In the keyword mnemonic method, one is specifically taught how to form and use keywords. Fair comparison of the keyword mnemonic method to the contextual analysis method

requires comparable instruction in the context method regarding how context can be used to infer word meanings.

Gipe (1979) compared four methods of learning new English vocabulary words. These methods included association, categorization, contextual analysis, and dictionary approaches. His subjects were third and fifth grade students from four intact classrooms at each grade level. The dependent variable for this study was the total number of correct words written in the blank space of provided sentences. The results of this study indicated that a contextual approach (in which subjects were provided with sentence contexts and then asked to relate the vocabulary word to their own experiences) was significantly better than the other three methods on the sentence recognition task ($p < .001$). However, the results of this study should be interpreted with caution given that the amount of study time allocated to each condition was uncontrolled. In addition, a within-subjects design was employed that may have produced unknown carryover effects from one method to the next.

Gipe (1981) conducted two additional experiments to lend further support to the contextual analysis method. In the first experiment, however, Gipe was unable to replicate her previous findings. In the second experiment, she concluded that subjects assigned to the contextual analysis strategy condition performed significantly better than subjects in the no-strategy control condition. It should be recognized that

the no-strategy control subjects were not given any instruction. However, they were exposed to the targeted words and their definitions. All subjects were given a pretest and a posttest on the definition of targeted words. These findings must be interpreted with caution given the methodological flaws. First, when given some exposure compared to no exposure, the words will more likely be remembered. As emphasized by Stahl and Fairbanks (1986), a strategy that provides multiple exposures to word-definition pairs has a more profound effect on vocabulary learning than one that gives a single or double exposure to the items to be remembered. Furthermore, a no-exposure control group seems to be more appropriately utilized when examining the effects of vocabulary instruction on an outcome such as reading comprehension, rather than when contrasting the effects produced by various vocabulary-learning strategies (Stahl & Fairbanks, 1986). Stahl and Fairbanks (1986) suggested for analysis of this latter type of comparison, a no-instruction control group in which subjects are allowed to study the targeted words and definitions any way they desire seems to be the best baseline for establishing the effects of other, more novel, strategies.

Keyword Mnemonics Compared to Contextual Analysis

Researchers have been examining the effects of keyword mnemonic strategies compared to contextual analysis strategies for learning and retaining specific vocabulary

terms (McDaniel, Pressley, & Dunay, 1987; Pressley, Levin, & Miller, 1982; Sweeny & Bellezza, 1982). In general, the keyword mnemonic method has produced greater definition recall than when vocabulary words were presented in context as represented in the literature throughout the 1980s. Seven studies comparing keyword mnemonic strategies to contextual analysis strategies conducted in this period were located and are reported. Four of the studies contained two additional experiments (Levin, McCormick, Miller, Berry, & Pressley, 1982; McDaniel & Pressley, 1984, 1989; McDaniel, Pressley, & Dunay, 1987) comprising a total of eleven studies. These studies are summarized and critiqued in Table 2-2 and in the following sections. The research designs, subject characteristics, measurement methods, experimental procedures, and results are discussed.

Research Design and Description of Conditions

All experimenters used a group research design to evaluate the effectiveness of keyword mnemonic strategies when compared to contextual analysis strategies on the acquisition and recall of vocabulary meanings. Random assignment of subjects to treatment conditions occurred in all reviewed studies.

Ten of the investigations compared a keyword mnemonic strategy to a contextual analysis strategy incorporating a three-sentence context. Levin et al. (1982) used a one-sentence context for a contextual comparison condition in his

Table 2-2

Review of Keyword Mnemonic Vocabulary Studies with Contextual Analysis Methods

Investigators	Subjects	Interventions	Content
Pressley, Levin, & Miller (1982)	120 introductory psychology -University of Western Ontario	Imagery Keyword Mnemonic Sentence Keyword Mnemonic Sentence Judgment Sentence Generate Sentence Provided Free-Study Control	32 English vocabulary terms -low frequency -easily identifiable -concrete (imageable) -no greater than 3 syllables

Results: The students' recall of word meanings who were in the imagery keyword condition was statistically better than students' recall who were in the control condition and all the sentence-contextual conditions, regardless of whether the data were scored according to strict or more lenient criteria. Subjects in the sentence keyword condition did not produce significant differences on recall of definitions, but the performance of sentence keyword subjects was greater than the control subjects when essence definitions were accepted, and to subjects in the free-study control group and to subjects in two of the sentence-contextual variations when meaning fragments were allowed. Learning in none of the sentence context conditions was significantly greater than that in the free-study control condition.

Levin, McCormick, Miller, Berry, & Pressley (1982)	30 - fourth graders 2 - elementary schools	Mnemonic Keyword Contextual Free-Study Verbal Contextual	13 vocabulary terms -verbs -thought to be difficult to grasp (abstract)
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Experiment 1

Results: Subjects in the keyword mnemonic condition had a greater mean performance (82.8% correct) than that of subjects in the control condition (55% correct). These researchers concluded that fourth grade elementary students could adapt the keyword mnemonic strategy to learn vocabulary terms that were not selected on the basis of their being well suited to the keyword method.

Table 2-2--continued

Investigators	Subjects	Interventions	Content
Levin, McCormick, Miller, Berry, & Pressley (1982)	64 - fourth graders -3 classrooms from one elementary school	Keyword Context Experimental Context Picture Context Free-study -rote	14 vocabulary terms
Experiment 2			
Results:	Statistical analysis revealed that students in the keyword context condition substantially outperformed those in the control condition, the picture context condition, and subjects in the experimental context differed significantly from controls.		
McDaniel & Pressley (1984)	69 introductory psychology students -University of Notre Dame	Keyword Mnemonic Contextual Analysis Combined Keyword and Contextual Analysis Free-Study Control	61 English terms -obscure
Experiment 1	-received extra credit points for participation		
Results:	Subjects in the keyword mnemonic condition had greater total recall when strict scoring procedures were used than either the context condition or combined condition, although not more effective than students in the free-study control condition. Even when utilizing liberal scoring methods context subjects did not recall as much as subjects in other conditions. There was no evidence in the overall analysis to support the position that the context method was a more effective method of vocabulary learning relative to the free-study control procedures or to the keyword method. The keyword mnemonic method was not significantly better than the free-study control method. A supplementary analysis revealed that students with low-ability in the keyword condition performed significantly better than the other treatment conditions, but not the high-ability subjects.		

Table 2-2--continued

Investigators	Subjects	Interventions	Content
McDaniel & Pressley (1984)	42 introductory psychology students -Indiana University	Keyword Mnemonic Contextual Analysis	61 English terms -obscure
Experiment 2	South Bend -received extra credit points for participation		
Results:	Students in the keyword mnemonic condition outperformed students in the Contextual analysis condition on recall in both strict and liberal scoring procedures. The number of correct sentences generated also was significantly greater for students in the keyword mnemonic condition than students in the contextual analysis condition. There were no significant differences between conditions if a word's meaning was recalled then, at least one or two sentences were generated correctly.		
Condus, Marshall, & Miller (1986)	64 - 12-year-olds -LD students -"poor readers" -4 public elementary schools	Keyword-Image -Teacher provided Picture Context Sentence Experience Control Free Study	50 vocabulary terms -5 sets of 10 words
Results:	All subjects in the three treatment conditions significantly performed better than subjects in the control condition. Subjects in the keyword-image condition recalled more definitions in all other treatments across four levels of time (immediate, end of week, 2 weeks later, 8 weeks later).		

Table 2-2--continued

Investigators	Subjects	Interventions	Content
McDaniel, Pressley, & Dunay (1987)	42 introductory psychology college students -medium sized Midwestern University	Keyword Mnemonic Contextual Analysis -no definition -3 sentence context	30 English vocabulary terms -obscure
Experiment 1			
Results:	All subjects required at least two study-test trials before they could provide correct definitions for all the words when provided with the vocabulary terms. Subjects in the keyword mnemonic condition recalled significantly more definitions than did subjects in the contextual analysis condition on the first two learning trials. Despite differences in the acquisition of terms, the different instructional methods produced nearly equivalent retention scores 1 week after instruction.		
McDaniel, Pressley, & Dunay (1987)	40 college students -same university as Experiment 1	Keyword Mnemonic Contextual Analysis -definition -3 sentence context	30 English vocabulary terms -obscure
Experiment 2			
Results:	(Similar to Experiment 1) All subjects required at least two study-test trials before meeting the learning criterion. Subjects in the keyword mnemonic condition recalled significantly more definitions than subjects in contextual analysis condition on both learning trials and required significantly fewer trials to meet criterion. Both groups performed equivalently on the 1 week delayed-cue recall test.		
McDaniel & Tillman (1987)	45 introductory psychology college students	Keyword Mnemonic Contextual Analysis Free-Study Control	60 English vocabulary terms -uncommon terms
Results:	Subjects in the keyword mnemonic condition produced significantly greater definition recall than subjects in the context condition when recall was cued with the vocabulary term. No significant differences were found between subjects receiving the keyword mnemonic method and subjects receiving the contextual analysis method for free recall of definitions or free recall of the vocabulary terms.		

Table 2-2--continued

Investigators	Subjects	Interventions	Content
McDaniel & Pressley (1989)	75 introductory psychology college students -University of Notre Dame -participated for extra credit course	Keyword Mnemonic -interactive image on own Semantic Context -3 sentence passage -definitions Free-Study Control	45 vocabulary terms -Old English
<p>Results: Subjects in the keyword mnemonic condition produced significantly better recall of definitions than subjects in both the context and free-study conditions. No differences between the instructional conditions were found when looking at reading times of embellished and unembellished texts. The meanings of vocabulary words that were embedded in the embellished texts were better recalled than those embedded in unembellished texts. For words viewed once, the keyword method produced better definition recall than either the control condition, or the context condition. Similar results were found for twice presented words.</p>			
McDaniel & Pressley (1989)	72 undergraduate college students -Purdue University -part of requirements in introductory psychology course	Keyword Mnemonic (e) Keyword Mnemonic (u) Semantic Context (e) Semantic Context (u) Free-Study Control (e) Free-Study Control (u)	45 vocabulary terms -Old English
Experiment 2			
<p>Key: e = embellished u = unembellished</p>			
<p>Results: Vocabulary instructional techniques did not significantly influence how fast subjects could access and integrate vocabulary meanings when encountering those vocabulary terms in text. For vocabulary recall, the context group tended to recall less than either the keyword group or free-study group. No significant differences were found between conditions. A subsidiary finding was that the test text embellishments increased comprehension.</p>			

first experiment. The percentage of correct responses for each condition was compared and examined using t-tests. In Experiment 1, Levin et al. (1982) compared a teacher-provided keyword mnemonic context condition to a control free-study condition. In Experiment 2, a picture context condition without keywords and experiential context condition were compared in addition to the two conditions of Experiment 1.

McDaniel and Pressley (1984) and Pressley, Levin, and Miller (1982) also used t statistics to compare instructional conditions. McDaniel and Pressley (1984) compared a keyword mnemonic strategy to three other conditions in Experiment 1: (1) Contextual analysis--three-sentence context, no definition provided; (2) combined keyword mnemonic and contextual analysis; and (3) free-study control. To further convince their colleagues in the field of vocabulary research, these authors replicated the original study in Experiment 1. In Experiment 2, the keyword mnemonic method was compared to the contextual analysis condition of Experiment 1. An additional measurement procedure was added in Experiment 2 that required subjects to produce meaningful sentences with the targeted vocabulary terms.

Pressley, Levin, and Miller (1982) compared two keyword conditions, one based on the construction of visual images and the other based on the construction of sentences (Atkinson, 1975), to four other vocabulary strategy conditions. Both an imagery keyword and sentence keyword

were compared to each other as well as three different verbal-contextual approaches to vocabulary instruction and a control group. The three verbal-contextual conditions included a sentence-judgment condition, a sentence-generate condition, and a sentence-provided condition. All comparisons involving the control condition were conducted as one-tail tests, whereas all other comparisons were conducted as two-tailed tests.

Four investigations utilized ANOVAs to examine effects of the strategy conditions. Condus, Marshall, and Miller (1986) investigated the effectiveness of the keyword mnemonic method related to two contextual methods and a control group: picture context, sentence-experience context, and a free-study control condition. Experimenters in the picture-context condition taught subjects vocabulary definitions by presenting illustrations of the definitions of the targeted terms. Subjects in the sentence-experience context condition learned the meanings of words by following a two-step procedure. In the first step, students listened to and then reread a three-sentence passage that was printed on a sheet of paper. No definition was provided. Instead, students were expected to understand the word's meaning through the context of the three sentences. In the second step, students had to relate the meaning of the word to a personal experience. Finally, students in the free-study control condition were provided with a list of the targeted terms and

their definitions, pencils, and additional paper.

Experimenters instructed these subjects to choose their own method of studying to learn the definitions. A two-step analysis procedure--three-way ANOVA--was used to analyze the four-treatment condition by the two receptive-language abilities by the four-time measures, a 4 X 2 X 4 factorial design with repeated measures. A Scheffe post hoc comparison was used to analyze significant interactions.

McDaniel and Tillman (1987) also compared keyword mnemonic condition to a contextual analysis condition and control condition using ANOVA procedures. Keyword mnemonic subjects were provided a keyword and told to form an image of the keyword interacting in some way with the definition of the vocabulary term. Experimenters instructed subjects in the context condition to interfere each vocabulary word's meaning from three sentences provided on a card. These subjects were also taught internal and external cues (Sternberg et al., 1983) that may be found in a text to aid in the discovery of a word's meaning. Control subjects were told to learn each word and its definition any way they wanted. A two-factor mixed analysis of variance of the number of definitions correctly recorded indicated no difference between treatment conditions.

McDaniel and Pressley (1989) also compared keyword mnemonics to contextual analysis instruction in two experiments. In Experiment 1, three conditions were

compared: (1) keyword mnemonic; (2) semantic context; and (3) free-study control; whereas, in Experiment 2, six conditions were compared: the three conditions in Experiment 1 and two text conditions, embellished and unembellished text. Again, the subjects in the keyword condition were provided a keyword for each targeted term and told to imagine an interactive image. The subjects in the semantic context condition were provided both a three-sentence passage and a one- or two-word definition. For the control condition, students received each word and its one- or two-word definition. A three (instructional condition) by two (embellished or unembellished story) between-subjects ANOVA of average reading time was used to show differences between conditions. Comprehension was analyzed with a two-factor between-subjects ANOVA with instructional condition and text type (embellished vs. unembellished) as factors.

All subjects were instructed to read two short stories presented on the computer screen. Fifteen of the targeted terms were embedded in each story. The particular story presented to a subject was counterbalanced across instructional conditions. Two formats were devised for each story. One format, embellished, provided context words to help cue the meaning of a targeted term. For the second format, unembellished, the word cues were deleted. Additionally, in Experiment 2, the authors further analyzed subjects' overall comprehension of the texts. An ANOVA was

used to determine any differences between the treatment groups.

Vocabulary definition recall was analyzed with a three-factor mixed ANOVA, with the within-subjects being the number of times that the word was viewed prior to testing (one or two, depending on whether the word was encountered in the text) and the between-subjects variables being instructional condition and text type (embellished vs. unembellished).

McDaniel, Pressley, and Dunay (1987) were the only experimenters who did not specifically describe their statistical procedures for both of their experiments. Results were only reported comparing the keyword mnemonic condition to the contextual analysis condition in each of these experiments. These two treatment conditions were similar to previously described keyword and three-sentence passage contextual conditions. The difference between Experiment 1 and Experiment 2 was the inclusion of the term's definition along with a three-sentence passage in the contextual analysis condition in Experiment 2.

Subject Characteristics

Eight of the reviewed studies used subjects who were college students enrolled in introductory psychology courses (McDaniel & Pressley, 1984, 1989; McDaniel, Pressley, & Dunay, 1987; McDaniel & Tillman, 1987; Pressley, Levin, & Miller, 1982) from at least four different universities. Two of these experimental descriptions did not state the name of

the university subjects were selected from (McDaniel, Pressley, & Dunay, 1987; McDaniel & Tillman, 1987). Conmus, Marshall, and Miller (1986) conducted their investigation with 12-year-old subjects who had been identified as Learning Disabled (LD) and further classified as having "low" or "high" receptive vocabularies based on the subject's performance on the Peabody Picture Vocabulary Test-Revised. Fourth grade subjects from two elementary schools participated in the two Levin et al. (1982) studies.

Measurement Methods

All reviewed studies used posttest measures to ascertain the effectiveness of the compared conditions. Two experiments also included a pretest (Conmus et al., 1986; Pressley et al., 1982). Pressley et al. (1982) gave subjects a short definition recall test on the sample items after demonstration of the strategy. The subjects were reminded of their strategy and were presented with the targeted terms. After instruction, subjects were given a self-paced test in which they had to write down the definition of each vocabulary word or as much of the definition as could be remembered.

All studies reviewed included definition recall among the dependent measures. Levin et al. (1982) presented targeted terms individually to students on cards and asked the students to state the meaning of the word. Students received a prompt by the experimenter if a subject's response

did not provide a definition of the word. All responses and the use of prompts were recorded by the experimenter.

McDaniel and Pressley (1984) evaluated subject recall after the training session by administering a sheet of paper with a listing of the words. Students were allowed as much time as needed to write the definitions. Subjects in both the context condition and combined keyword-context condition were required to complete an additional assessment after the recall test. These subjects were asked to reread the texts in which each vocabulary word was embedded and write a short definition.

McDaniel, Pressley, and Dunay (1987) examined delayed recall of terms one week after instruction. Students repeated treatment acquisition procedures until they could provide the correct definitions for all targeted words. One week later, students attempted to recall the definition for each target term. Experimenters did not describe whether subjects were required to write or state the definitions.

McDaniel and Tillman (1987) incorporated a free recall test, as well as a cued recall test. The free recall measure required students to write as many words and definitions as possible after instruction. After completing this task, students were given a sheet with a list of the words and asked to write the definitions.

McDaniel and Pressley (1989) assessed comprehension, as well as recall. In Experiment 1, subjects were given a true-

false test to measure comprehension. In the second experiment, the experimenters asked subjects to recall as much of the exact story as they could. Afterward, they received a 15-item cued-recall test containing one question for each of the targeted vocabulary terms.

Conodus et al. (1986) were the only researchers that assessed subjects' knowledge of vocabulary definitions using a multiple-choice test format. These authors also included a pretest two weeks prior to treatment so subjects could be grouped according to either high-language or low-language abilities. These experimenters repeated the multiple-choice measure in four phases: immediately after instruction, at the end of the week, 2 weeks later, and 10 weeks after instruction.

Experimental Procedures

Most of the reviewed studies were conducted within one session (Levin et al., 1982; McDaniel & Pressley, 1984, 1989; McDaniel & Tillman, 1987; Pressley, Levin, & Miller, 1982). McDaniel, Pressley and Dunay (1987) had a one-day session, but measured recall after 1 week. Conodus et al. (1986) conducted their study over a 17 week period. Five weeks were devoted to intervention, 3 days of intervention per week. Assessment measures occurred in weeks both prior to and after intervention. The total instructional time for each session ranged from 15 minutes (McDaniel, Pressley, & Dunay, 1983) to 25 minutes (McDaniel & Pressley, 1984; McDaniel & Tillman,

1987). The total instructional time for daily sessions was not stated in two of the studies (Levin et al., 1982; Pressley, Levin, & Miller, 1982), but experimenters stated that time spent in treatment conditions was equal.

Materials. A variety of media was used to present vocabulary information in the reviewed studies. Five of the experiments used cards (e.g., 4" X 6", 5" X 8") that contained critical information of the vocabulary term for each treatment condition. McDaniel and Pressley (1984) presented vocabulary information in eight-page booklets containing eight entries per page except for the last page, which had only five entries. A cassette tape was made to go with each booklet for each condition. McDaniel and Pressley (1989) utilized computers to present vocabulary information. McDaniel, Pressley, and Dunay (1987) presented vocabulary information on a cathode-ray tube.

Instructional medium. All but one study used trained experimenters who were not the subjects' teachers to conduct the study. However, Conduet et al. (1986) trained seven teachers of students with learning disabilities. Each teacher was trained proficiently in experimental and control conditions. Small group instruction was conducted in the teachers' resource classroom. Teachers were blind as to the experimental status of the condition they were teaching. Testing was conducted by independent examiners. The testing

in all other reviewed studies was also conducted by experimenters.

Experimental constants. All investigators strived to keep instructional techniques and materials constant throughout the investigation periods. Several authors kept instruction paced by mechanical means (e.g., tape recorders, computer presentation, timers) (McDaniel & Pressley, 1984, 1989; McDaniel & Tillman, 1987). However, instruction relative to each condition differed even though time spent learning the words remained constant. The keyword mnemonic subjects received explicit instructions on that strategy. Only one of the reviewed studies provided strategy training for subjects in the contextual analysis condition (McDaniel & Tillman, 1987). These subjects were typically presented with information about the targeted term, not how to use the strategy.

Results

Six studies (Conduet et al., 1986; Levin et al., 1982; McDaniel & Tillman, 1987; Pressley, Levin, & Miller, 1982) found the keyword mnemonic strategy significantly better than either the contextual analysis or control free-study condition. McDaniel, Pressley, & Dunay (1987), however, found that despite significant differences in the acquisition of vocabulary terms, the different instructional methods produced nearly equivalent retention scores one week after instruction.

McDaniel and Pressley (1989) also did not produce significant results in Experiment 2, even though the context group tended to recall less than either the keyword group or control free-study group. McDaniel and Pressley (1984) found significant differences between treatment conditions, but the keyword mnemonic method was not significantly better than the free-study control method. A supplementary analysis revealed that students with low-ability in the keyword condition performed significantly better than other treatment conditions, but not the high-ability subjects. Condis et al. (1986) also found results from the 10-week follow-up assessment produced data that indicated that students with low receptive vocabularies in the keyword mnemonic condition learned more definitions on the average than students with high and low receptive vocabularies assigned to all alternative conditions.

Even though experimenters such as Condis et al. (1986) demonstrated that the keyword mnemonic strategy was effective when implemented in small group classroom settings, one must view these findings cautiously. First, the vocabulary words chosen for this and the other reviewed studies were words that contained concrete keywords that were easily identified. If words were specifically chosen to favor one of the treatment conditions, then all conditions are not equal from the start.

Researchers studying the effects of the keyword mnemonic strategy compared to contextual approaches may find less dramatic results when all conditions are controlled to have equal strategy training. Although trends can be detected, the results presented in the studies reviewed are inconclusive. It is apparent that further research is needed to help determine the most effective strategies for vocabulary instruction.

Summary

The strategy instruction examined in these research studies is of great importance to educators who are teaching students experiencing little academic success. Mildly disabled adolescents who have been trained with the keyword mnemonic strategy to help them learn new vocabulary terms have made impressive learning gains, when compared to other strategy interventions. Mnemonic instructional methods have also produced positive results in learning textbook content with mildly disabled students. Although the keyword mnemonic strategy appears to be more effective for the acquisition and retention of information by mildly disabled adolescents, an examination of the literature reveals a lack of research to support the effectiveness of this strategy with at-risk adolescents.

The results of existing studies comparing keyword mnemonic strategies to contextual strategies and free-study control conditions are inconsistent. Therefore, further

exploration is evident. The purpose of the present study was to extend the research comparing keyword mnemonic strategies to other contextual and control conditions and to determine whether at-risk adolescents could benefit from the keyword mnemonic strategy.

CHAPTER 3 METHODS

The research methods in this investigation were designed to assist the investigator in comparing subjects' recall of the definitions of geography terms among three treatment conditions: keyword mnemonics, contextual analysis, and rote free study. Recall effects on initial acquisition, short-term retention, and long-term retention of definitions in each condition were measured. The research methodology including descriptions of subjects, null hypotheses, instrumentation materials, procedures, and experimental design and analysis is presented in this chapter.

Subjects

The subjects for this study were seventh grade students who have been identified as students at risk for dropping out of school. All students were placed in alternative education programs according to the criteria required by the Orange County school system. These criteria include students having two or more of the following characteristics: failure of two or more subjects, failure of one or more grades and currently unsuccessful, frequent unexcused absences, frequent discipline problems, evidence of low self-esteem, poor social skills, loneliness, or stressful loss (Student Alternative Programs Department of Special Services, 1992). Ninety-eight

7th grade students participated in this investigation. All subjects received treatment instruction from their alternative education teacher in their geography classroom located in Orange County, Florida. Each teacher was randomly assigned to one of the three treatment conditions.

Additional subject characteristics are presented in Table 3-1 adapted from the recommendations of Smith, Deshler, Hallahan, Lovitt, Robinson, Voress, and Ysseldyke (1984). These authors suggested including gender, age, ethnicity, socioeconomic status (SES), intelligence quotient (IQ) scores, and achievement scores. Since many students who have been identified as at risk for dropping out of school have never been recommended for an exceptional student evaluation, IQ scores were unavailable. Since IQ scores were unavailable, standard scores from the Comprehensive Test of Basic Skills (CTBS) are included in describing subject characteristics. Additional information on previous retentions of subjects are also included. All subjects participated in a screening procedure to determine both subject eligibility for participation in this study and to target unfamiliar geography terms from the state adopted seventh grade geography texts used in the Orange County School System. The purpose of this screening was to ascertain that the students were unfamiliar with the definitions of the geography terms identified for the study. The screening consisted of 90 geography terms. The students

were required to write the definition of each term. Critical components of the definitions described in the texts' glossary or written text were used to determine correct and incorrect responses. An overall score of less than 40% of terms defined correctly determined subject eligibility for participation. Results of the screening are reported.

Table 3-1
Description of Subjects

Mnemonic Keyword		Context Clue		Rote Memory	
Numbers:		Numbers:		Numbers:	
Male	13	Male	21	Male	19
Female	15	Female	13	Female	17
Total	28	Total	34	Total	36
Age:		Age:		Age:	
Mean	12.5	Mean	12.8	Mean	12.2
Range	12-14	Range	11-15	Range	11-13
Ethnicity:		Ethnicity:		Ethnicity:	
Anglo	04	Anglo	12	Anglo	16
African A.	24	African A.	19	African A.	16
Hispanic	00	Hispanic	03	Hispanic	02
Other	00	Other	00	Other	02
CTBS Rd. Stan. Score:		CTBS Rd. Stan. Score:		CTBS Rd. Stan. Score:	
Mean	637.61	Mean	643.85	Mean	645.59
Range	516-755	Range	476-789	Range	476-723
SD	54.17	SD	71.36	SD	60.99
Num. of Retentions:		Num. of Retentions:		Num. of Retentions:	
Mean	0.14	Mean	0.76	Mean	0.19
Range	0-1	Range	0-3	Range	0-1

Hypotheses

The dependent variables examined in this study were the recall of geography terms' definitions for subjects taught in one of three ways. The three interventions were teacher-provided keyword mnemonics, teacher-provided contextual analysis, and rote free study. The subjects' recall of definitions was measured for acquisition during the instructional intervention, short-term retention at the end of the week after instruction, and long-term retention two weeks after instruction had ended. Recall was measured by using a written (production from memory) format. In addition, the subjects' rate of acquisition of definitions was analyzed during each instructional week. The following null hypotheses addressed the effects of the three treatment conditions regarding student performance related to acquisition and retention.

H1: There will be no statistically significant differences among the three experimental groups on acquisition of geography terms' definitions recalled on the day instruction has occurred.

H2: There will be no statistically significant differences among the three experimental groups on short-term retention of geography terms' definitions recalled at the end of the week following instruction.

H3: There will be no statistically significant differences among the three experimental groups on long-term

retention of geography terms' definitions recalled two weeks following instruction.

The .05 level of significance was used as the basis for rejection of a null hypothesis.

Instrumentation

Four teacher-made research instruments were used in this study. The first instrument, the Written Geography Term Definition Screening Device, was used to determine if students could write the definitions of less than 40% of the geography terms. The second instrument, the Daily Measure of Geography Terms' Definitions Device, was used during each instructional session to help compare the rate of acquisition for subjects in each condition. The third instrument, the Teacher Survey to Evaluate Content Validity, was sent to 21 Orange County middle schools. Each school had approximately six social studies teachers who received the survey in order to obtain an external evaluation of content validity as recommended by Ary, Jacobs, and Razavieh (1985). The selected number of words used for instructional conditions was based upon the survey results and validation of professionals in the educational system. The fourth instrument, the Geography Terms' Definition Device, included all targeted terms and was administered weekly during this investigation. Varied forms of the Geography Terms' Definition Device were used with the words randomly ordered on each form. These criterion measures were used to

determine subjects' performance regarding acquisition, short-term, and long-term retention.

Ninety words were used during the screening (see Appendix A), and a percentage of these words was randomly selected for use in this study dependent upon the results of the teacher survey and the screening device. The words that were not selected for the study were used as example words for the first day of instruction during each of the four instructional strategy training weeks (see Appendix D).

Written Geography Term Definition Screening Device

The Written Geography Term Definition Screening Device (see Appendix B) required the subjects to write the definitions of as many of 90 seventh grade geography terms as they could. Students had as much time as they needed to complete this screening device. Students were only given credit for complete definitions. Partial credit was not awarded. Subjects with scores of less than 40% were eligible for participation in this investigation.

Teacher Survey to Evaluate Content Validity

The Teacher Survey to Evaluate Content Validity (see Appendix C) was used to obtain an external evaluation of content validity. The survey was sent to all social studies teachers in each Orange County middle school. Each assistant principal of instruction or principal was asked to distribute the survey to the social studies teachers in their school. Approximately 120 surveys were sent out to be given to

teachers. The assistant principal or principal was also asked to retrieve the surveys and send back one week after they had received them. The information obtained from the surveys was used to develop the Daily Measure of Geography Terms' Definition Device and the Geography Terms' Definition Device.

Daily Measure of Geography Terms' Definition Device

The Daily Measure of Geography Terms' Definition Device (see Appendix D) was used immediately following instruction on the first, second, third, and fourth day of instruction. An analysis and comparison of the rate of acquisition of geography definitions for subjects in all three conditions was determined from this device. Learning trends were also analyzed. Each week the Daily Measure of Geography Terms' Definition Device had the targeted words to be used for that week's instruction. Each day's device had the targeted terms listed randomly for the subjects to write the definition of the geography terms that they remembered. Individual percentage scores for subjects in each treatment group was used to analyze the results of this procedure.

Geography Terms' Definition Device

The Geography Terms' Definition Device (see Appendix E) consisted of all the terms that were used during the study. Forty-eight words were selected randomly select from the original 90 words was determined after the results of the teacher survey and screening device had been analyzed.

Twelve of the terms not selected were used as demonstration words on each Day 1 of the 4 instructional implementation weeks. Varied forms of the device were used throughout the investigation listing the targeted words in random order. This evaluation instrument was given on Day 5 of each instructional implementation week.

Materials

Materials used with students receiving the keyword mnemonic instruction included four 5 x 8 cards per targeted geography term. The first card had a geography term on it. The second card had the geography term, the definition, and an illustration of the definition. The third card had the word "think" at the top and an associative saying or keyword in a box with an illustration to go with the saying or keyword. The fourth card had the geography term at the top, the illustration from the definition card, and the associative illustration (or keyword) interacting with the picture from the definition card. Each targeted word was instructed using these four cards for this teaching condition.

Subjects in the contextual analysis condition were taught geography terms with three 5 x 8 cards for each targeted geography term. The first card had a geography term as in the mnemonic condition. The second card, however, had from two to four sentences on it, with the geography term and the contextual definition highlighted. The third card had

the same illustration used on the definition card in the mnemonic condition. A chart with information on specific context clues was displayed in each classroom for students receiving this instruction throughout the study.

Students in the third condition, rote free-study, were given two 5 x 8 cards for each targeted geography term. The first card had a geography term as in the other two conditions. The second card had the definition of the targeted term and an illustration of the definition as used in the mnemonic condition. Index cards (3 x 5) were available for subjects in all conditions to use. For examples of the instructional cards used for each condition, see Appendix F.

Procedures

The procedure for this study was divided into four phases. Phase one was the collection of information regarding geography terms from middle school social studies teachers who were teaching in the Orange County school system during the 1992-1993 school year and the screening of subjects in order to determine eligibility for participation in the study and targeted terms. Phase two was a training period for the teachers involved in the study. Phase three was the instructional implementation that occurred over 4 weeks. During each week of the study, instruction of the geography terms targeted for the week took place at the beginning of the class period on days 1, 2, 3, and 4 of each

week. The subjects were assessed after instruction on Days 1, 2, 3, and 4 by giving them the Daily Measure of Geography Terms' Definition Device to determine initial acquisition of the targeted terms. The subjects were given five minutes after instruction to complete this assessment. The fourth phase included assessment on both short-term and long-term retention of the targeted geography terms. The subjects were assessed on Day 5 of each week using the Geography Terms' Definition Device to determine short-term retention. In order to determine long-term retention, a final assessment was given two weeks after all instruction had taken place. The remainder of this section provides an overview of each procedural phase in greater detail.

Survey and Screening Procedure (Phase One)

A survey and screening procedure was used to target unfamiliar geography terms and the number appropriate for use in the study as well as to determine subject eligibility for participation in the study. The survey was sent to all middle school social studies teachers via an administrator at their school. This survey was sent in order to obtain an external evaluation of content validity. The survey included 90 geography terms selected from two Florida, state adopted geography curricula. Teachers were asked to mark any geography term that was not appropriate to learn for the seventh grade geography curriculum. Information was also obtained regarding each teacher's years experience teaching

geography and expectations for geography term acquisition for seventh graders (see Appendix C). The 48 geography terms used for instructional and assessment procedures were based upon the results of this survey.

A screening of possible subjects was also conducted to make certain that the subjects were unfamiliar with the definitions of the targeted geography terms. This screening consisted of the same 90 geography terms sent to the surveyed teachers. The students were required to write the definitions of as many terms as they could. The screening device was untimed. Critical components of the definitions described in the text's glossary or written text were used to determine correct and incorrect responses. An overall score of less than 40% of terms defined correctly determined subject eligibility for participation. Results of the screening are reported in Chapter 4.

Teacher Training Procedures (Phase Two)

The teachers volunteered to participate in this study, but the requests for their participation came from the Director of Alternative Education Programs and the principal of their school. These teachers attended several training sessions, either as a group or individually, prior to strategy implementation. Each teacher who completed the study received 60 inservice points towards recertification of their teaching certificate. Teachers were taught effective teaching strategies and were exposed to effective teaching

research. The training procedures are outlined in Appendix G. Each teacher demonstrated mastery in administering the instructional procedures prior to beginning the treatment conditions with any subjects in the study. A Time Sampling Record Form (see Appendix H) was used by independent observers to assess each teacher's proficiency in following the script, following the sequence of the script, a consistent pacing of the instruction, and using the materials correctly for the treatment condition. While each teacher demonstrated a lesson, two independent observers listened to a cassette tape with prerecorded beeps designated at two 30-second intervals during five minute blocks for 20 minutes. Each time a beep was heard, the observers recorded either appropriate or inappropriate teacher behaviors on the Time Sampling Record Form. Interval agreement (i.e. $[\text{Agreements} + (\text{Agreements} + \text{Disagreements})] \times 100 = \text{Percent of Agreement}$) was calculated using the interval by interval or point by point method (Tawney & Gast, 1984). Miller's (1975) .90 standard was used as the criterion for adequate agreement. Interobserver reliability is reported in Chapter 4.

A combination of effective teaching methods was used throughout all conditions. Teachers were taught the various concepts and techniques that have been proven to enhance the quality of instruction for increased student learning (Wang, 1987). Many of these techniques evolved from the research on direct and systematic instruction (Becker, Engelmann,

Carnine, & Rhine, 1981; Gersten & Carnine, 1984; Rosenshine, 1979). The term "direct instruction" evolved out of the field of compensatory education for teaching low income students in the late 1960s and 1970s. Rosenshine (1979) used the phrase "direct instruction" to describe patterns of teacher behavior and classroom organization. His conceptions of these effective techniques were based on research conducted in regular education classrooms, often with low income students (Gersten, Woodward, & Darch, 1986). Rosenshine (1979) concluded that low-performing students repeatedly improved academic performance when teachers followed a consistent format of demonstration, guided practice, and feedback. The teachers in this study were instructed to provide a clear, controlled presentation of the new material - demonstration, ask questions to check for the subjects' understanding, and provide feedback - guided practice and feedback.

Other essential elements of effective teaching procedures documented by research were also incorporated into all conditions. These methods included a rapid pace, each session beginning with an advanced organizer, a review of the previous lesson, a demonstration and modeling of the strategy, guided practice opportunities, active student participation, positive reinforcement, corrective feedback, and daily evaluation methods (Carroll, 1985; Engelmann, 1980; Gersten, Woodward, & Darch, 1986; Rosenshine & Stevens, 1986;

Walberg, 1984). These effective teaching procedures were formed into a first letter mnemonic to help teachers remember them. The first letter mnemonic was "All right! My great students really can excel" (see Appendix G).

Teachers were directed to carefully control the direction of each lesson by guiding subjects through scripted structured teaching sequences, using carefully worded definitions and precise instructional steps. The exact wording of key concepts and definitions was clearly specified. These teaching sequences were designed to help students focus on the most relevant information and concepts during content instruction as Engelmann and Carnine (1982) described.

Instructional Implementation (Phase Three)

Sixty targeted geography terms were used for each of the 4 weeks of strategy training based upon the results of the Teacher Survey to Evaluate Content Validity, 48 words for strategy intervention training and 12 words for demonstration purposes. Three demonstration geography terms from the list of words not randomly assigned to the targeted group of words used for instruction were used on Day 1 of each of the 4 weeks of intervention.

An initial screening device was administered to determine that the subjects not know the definitions of the targeted geography terms prior to instruction. The teachers told the subjects that they were not expected to know the

definitions of the targeted geography terms prior to instruction, but encouraged the students to look at each term and define any word they thought they may know. Subjects for the study were unable to define at least 85% of the geography terms correctly prior to implementation of this study. The subjects were in one of three strategy conditions of which teachers had been randomly assigned.

The Day 1 implementation period took 25 minutes to complete. The first five minutes included the advanced organizer for the week and day, as well as the demonstration of the strategy. The next 15 minutes included instruction on the targeted words. Following this instructional period, the subjects were given 5 minutes to be assessed on the geography terms targeted for that week's instruction (Daily Measure of Geography Terms' Definition Device).

On Days 2, 3, and 4, 25 minutes was also be used for implementation. The first minute included an advanced organizer for the day, followed by a review of the previous day's lessons for the remaining 4 minutes. The next 20 minutes remained the same as Day 1 with 15 minutes instruction on the targeted words for the day, followed by a 5 minute assessment.

During the beginning of the geography period on Day 5, subjects were assessed on all the geography terms targeted for the 4 weeks of instruction. This standard measure allowed the investigator to ascertain if the subjects'

learning of geography terms was the result of instruction. All subjects in each condition of strategy training received instruction on the same words each week. The pace of instructional time per word remained consistent throughout the three conditions. Instructional techniques also included the "All right! My great students really can excel" effective teaching procedures (see Appendix G).

Keyword mnemonic condition. The keyword mnemonic strategy of remembering unfamiliar terms was taught by two different teachers. The teachers in the keyword mnemonic condition instructed students to learn the meanings of the targeted geography terms by following nine steps. Four cards were used for each geography term. Teacher instruction followed a scripted lesson format (see Appendix I) paced by audible tones at intervals on a cassette recorder.

During the first step, the teachers introduced the geography term by showing the subjects a 5 x 8 card with the term printed on it while pronouncing the term. Next, the teachers then called on selected subjects to pronounce the term. During the third step, the teachers showed the subjects a 5 x 8 card with the geography term, the definition of the term, and an illustration of the definition on it. During the fourth step, the teachers again called on selected subjects to restate the definition. The fifth step included introducing the keyword. The third card had the word "think" at the top and an associative saying or keyword in a box with

an illustration to go with the saying or keyword. Subjects were instructed on the purpose of interacting the illustration of the geography term with the keyword. Again, the teachers called on selected subjects to restate the keyword for the sixth step. The seventh step included the teachers presenting the fourth card with the geography term at the top, the illustration from the definition card, and the associative illustration (or keyword) interacting with the picture from the definition card. The eighth step included the teachers calling on selected students to describe the keyword or phrase interacting with the illustration of the definition. The ninth step included a review by questioning subjects regarding the keyword, the interactive illustration, and the definition of the geography term.

Subjects were assessed for five minutes after instruction on Days 1, 2, 3, and 4 (Daily Measure of Geography Terms' Definition Device). On Day 5, the subjects were allowed 30 minutes to complete the Geography Terms' Definition Device to assess knowledge of the targeted terms' definitions. At the end of the sixth week, the Geography Terms' Definition Device was given again in order to assess long-term retention of the targeted geography terms' definitions.

Contextual analysis condition. The contextual analysis strategy of learning unfamiliar terms was also taught by two

different teachers. The teachers in the contextual analysis condition instructed students to learn the meanings of targeted geography terms by following a seven-step procedure. Three instructional cards were used for each targeted geography term. Teachers demonstrated example words during the beginning of instruction of each Day 1 of the four instructional implementation weeks. A cassette recorder with audible tones was used to pace the teacher. The teachers followed a scripted lesson format (see Appendix J).

The first step included introducing the term by showing the subjects a 5 x 8 card with the term printed on it while pronouncing the term. The teachers called on subjects to restate the term. Next, the teachers showed Card 2. Card 2 had two to four sentences on it with the geography term and contextual descriptions and clues highlighted. The teacher called on subjects and discussed how the contextual clues related to the definition of the targeted geography term. Next, the teachers showed Card 3 and described the illustration of the definition. The teachers instructed students to look for pictorial and graphic context clues, as well as semantic, syntactic, and typographical contextual clues to help understand new word meanings.

Subjects were assessed for 5 minutes after instruction on Day 1, 2, 3, and 4 (Daily Measure of Geography Terms' Definition Device). On Day 5, the subjects were given 30 minutes to complete the Geography Terms' Definition Device to

assess knowledge of the targeted terms' definitions. At the end the sixth week, the Geography Terms' Definition Device was given again to assess long-term retention of the targeted geography terms' definitions.

Rote free study condition. The rote free study strategy of learning unfamiliar terms was also taught by two different teachers. The teachers randomly assigned to the rote free study strategy group instructed students utilizing a similar number of steps as used in the other two conditions. Two instructional cards were used to teach each targeted geography term. Teachers also demonstrated example words at the beginning of instruction of each Day 1 of the four instructional implementation weeks. As in the other two conditions, a cassette recorder with audible tones was used to pace the teachers. The teachers also incorporated "All right! My great students really can excel" effective teaching procedures (see Appendix G) while following a scripted lesson format (see Appendix K).

The first steps included introducing the term by showing the subjects a 5 x 8 card with the printed term while pronouncing it as in the other two conditions. The teachers also called on subjects to restate the term. Next, the teachers showed Card 2 and stated the definition. Card 2 also had an illustration of the definition that was described. Students were instructed to remember the definition of the targeted geography term any way they wanted

to. The term and definition was repeated by both the teacher and subjects called on by the teacher.

Subjects were assessed for 5 minutes after instruction on Days 1, 2, 3, and 4 (Daily Measure of Geography Terms' Definition Device). On Day 5, the subjects were given 30 minutes to complete the Geography Terms' Definition Device. At the end of the sixth week, a form of the Geography Terms' Definition Device was given to assess long-term retention of the targeted geography terms' definitions.

Control variables. There were six controls for the instructional components of this study.

1. All the subjects spent the same amount of time learning the geography terms and definitions.
2. All subjects were taught by their classroom teacher.
3. The same geography terms were used for all conditions for each of the 4 weeks of instruction. All subjects were screened to assure lack of prior knowledge of a majority of the targeted words.
4. All conditions incorporated an illustration of each of the geography term's definition.
5. All conditions utilized the same evaluation methods. Five minutes was given at the end of Days 1, 2, 3, and 4 of instruction to write the definitions of the targeted words for that week. The evaluation on Day 5 included a 30-minute time limit for each subject to define as many of the targeted words as they could in all conditions. At the end of the

sixth week after implementation began, all subjects were given all the targeted words to define in 30 minutes.

6. Effective teaching procedures were used in all conditions. These techniques included beginning each lesson with an advanced organizer, review of previous lesson, modeling and demonstration, guided practice, student participation, reinforcement, corrective feedback, and evaluation.

Measurement (Phase Four)

Phase four included measurement of geography term definition acquisition, short-term, and long-term retention. The percentage of correct definitions of the geography terms was examined:

$$\frac{\text{Number of correct definitions}}{\text{Total number of terms on device}} \times 100$$

As previously described, subjects' acquisition of targeted geography terms was assessed daily throughout the study. On days 1, 2, 3, and 4 of instruction for each of the 4 weeks, students were given 5 minutes to complete the Daily Measure of Geography Terms' Definition Device. The subjects wrote the definitions on the line provided beside each targeted geography term for that week's instruction. The words were randomly assigned on three different forms of the assessment per week. Rate of acquisition and learning trends for subjects in each condition throughout the four instructional days were assessed from these daily measures.

On Day 5 of each of the 4 weeks of instructional implementation, the Geography Terms' Definition Device was given to subjects in order to measure short-term retention of targeted geography terms' definitions. The format remained the same as the daily assessments. This written assessment included all targeted geography terms taught throughout the study.

The targeted geography terms for the study were randomly assigned to three different forms of the Geography Terms' Definition Device. This device was also used 2 weeks (Week 6) after the completion of the four instructional implementation weeks in order to measure long-term retention of the geography terms.

Training on scoring procedures for correctness of written definitions was given to educational colleagues. One colleague scored assessments in a mixed order so that the scorer was unaware of treatment conditions for subjects. A second colleague scored a random selection of the assessments to assist in determining reliability in the scoring procedures. A reliability coefficient of .90 was used as a minimum standard as suggested by Salvia and Ysseldyke (1978). All colleagues were unaware of treatment conditions. The results of these assessments and the reliability for scoring are reported in Chapter 4.

Experimental Design and Analysis

The dependent variable was the subjects' written recall of targeted geography terms' definitions. The independent variables were the intervention conditions: (a) keyword mnemonic strategy instruction, (b) contextual analysis strategy instruction, and (c) rote free study strategy instruction. An analysis of variance (ANOVA) with repeated measures on time, (Huck, Cormier, & Bounds, 1974) was used to reject or accept each null hypothesis. A significance level of .05 was used.

A mean score was obtained for each subject by adding together all assessment scores across the repeated measure of time and dividing by the number of assessment opportunities. An average of these scores for the subjects in the keyword mnemonic condition yielded a mean score that corresponded to the main effect mean for this condition. A main effect mean was computed in this manner for each of the strategy conditions. A comparison of these three means was analyzed to see if there were significant differences among the three groups.

The main effect of the within-subjects factor was analyzed. Three mean scores, each representing the average score of all subjects on separate administrations (i.e., acquisition, short-term retention, and long-term retention) of the assessment measures, determined if subjects performed equally well on vocabulary acquisition and retention of the

targeted geography terms over time. An interaction between assessment performance and the three strategy groups was also examined. If these measures determined there is a significant main effect, a multiple comparison procedure was computed or a Tukey test, of post hoc comparison, was used to determine which differences were significant. The Tukey test was designed to cover all comparisons and was more powerful than other pairwise tests for simple contrasts (Keppel, 1982).

CHAPTER 4

RESULTS

Results of the study are presented in Chapter 4. The chapter includes summary statistics describing the raw data for a) interobserver agreement; b) interscorer reliabilities; c) vocabulary screening device; and d) the dependent variable, written definition recall. Results from the analysis of variance (ANOVA) with repeated measures are provided. These statistical analyses results are discussed related to the dependent variable and the three hypotheses stated in Chapter 3. Additional related findings and descriptive analyses of the data are also discussed. Finally, the results are summarized for all data and related findings.

Teacher Training Interobserver

An interval recording observation system, as described in Chapter 3, was utilized to gather information on each classroom teacher's proficiency for delivering their randomly assigned treatment condition. Each teacher was observed one time prior to the implementation phase of the study and at least once, three attempts were made, during weeks 2 through 4 of the implementation phase of the study. Interval agreement (i.e., $[\text{Agreements} + (\text{Agreements} + \text{Disagreements})] \times 100 = \text{Percent of Agreement}$) was calculated according to

procedures described by Tawney and Gast (1984). Miller's (1975) .90 standard was used as the criterion for adequate agreement. Criterion was met. The overall interobserver agreement for the six teachers during the teacher training phase of the study was 95%. The overall interobserver agreement for the six teachers during the implementation phase of the study was 99%. Although agreement was higher during the implementation phase, both observers noted some teachers were not following procedures specifically as written. For example, one teacher was marked as having adequate pacing by both observers, but was not using the timing tape provided for pacing. Individual scores for each observed teacher behavior are presented in Table 4-1.

Interscorer Reliability

All written assessment measures were scored independently by one of three educators who were "blind" with respect to treatment conditions. One educator graded all assessment measures for a particular week of treatment. A second educator checked a random 25% of the first scorer's weekly group of daily quizzes and weekly test to determine reliability. Scorers reached 100% agreement. Three "dummy" quizzes or tests were also put into each weekly packet of assessment measures to check further on scoring procedures. The scoring of these "dummy" measures was checked by the experimenter. Again, 100% agreement was met. A strict

Table 4-1
Interobserver Agreement on Teacher Behavior

Teacher	Script	Sequence	Pacing	Materials	Percentage
<u>Training Phase:</u>					
A Teacher 1	16/16	16/16	16/16	16/16	64/64 = 100%
Teacher 2	15/16	14/16	16/16	14/16	59/64 = 92%
B Teacher 3	16/16	15/16	16/16	15/16	62/64 = 97%
Teacher 4	13/16	16/16	16/16	16/16	61/64 = 95%
C Teacher 5	16/16	16/16	16/16	15/16	63/64 = 98%
Teacher 6	14/16	12/16	16/16	14/16	56/64 = 88%
Overall Interobserver Agreement During Training					365/384 = 95%
<u>Implementation Phase:</u>					
A Teacher 1	16/16	16/16	16/16	16/16	64/64 = 100%
Teacher 2	16/16	16/16	16/16	16/16	64/64 = 100%
B Teacher 3	15/16	16/16	16/16	16/16	63/64 = 98%
Teacher 4	16/16	16/16	16/16	16/16	64/64 = 100%
	16/16	15/16	16/16	14/16	61/64 = 95%
	16/16	15/16	16/16	16/16	63/64 = 98%
	16/16	16/16	16/16	16/16	64/64 = 100%
C Teacher 5	16/16	16/16	16/16	16/16	64/64 = 100%
Teacher 6	15/16	16/16	16/16	16/16	63/64 = 98%
	16/16	16/16	16/16	16/16	64/64 = 100%
	16/16	16/16	16/16	16/16	64/64 = 100%
Overall Interobserver Agreement During Study					761/768 = 99%

scoring procedure was used. Subjects only received credit for their response if the definition included all targeted concepts of a term's definition. No credit was awarded for partially correct responses.

Geography Term Definition Screening Device

All possible subjects were administered the Geography Term Screening Device. The results of the screening device are presented in Table 4-2. Subjects in all conditions could write approximately one of the definitions on the screening device. All of the subjects met the criterion established for participation in the study, at least 60% incorrect responses.

Table 4-2

Results of the Geography Term Definition Screening Device

<u>Condition</u>	<u>N</u>	<u>Mean Percentage Correct</u>	<u>Standard Deviation</u>	<u>Range</u>
A Keyword Mnemonic	25	1.04	2.20	0-8
B Contextual Analysis	30	1.40	2.47	0-13
C Rote Free Study	30	1.40	1.67	0-8

An analysis of variance test confirmed that there were no significant main effects among the three groups on the

Geography Term Definition Screening Device. Results of the analyses are reported in Table 4-3.

Table 4-3

Summary Table for the Geography Term Definition Screening Device

Source of Variance	df	MS	F	p
Method	2	1.14	.25	.781
Error	82	4.58		

Statistical Analysis of the Data

Data on dependent measures, daily quizzes and weekly tests, were analyzed separately since they represented a different number of targeted terms. The independent variables were the three interventions: (a) keyword mnemonic, (b) contextual analysis, and (c) rote free-study. Data on both measures were analyzed to determine the relative effectiveness of the independent variables in relation to the three hypotheses. Results from an analysis of variance (ANOVA) with repeated measures on time was used to reject or accept each null hypotheses at the .05 significance level.

Hypothesis 1

The first hypothesis was that there would be no statistically significant differences among the three experimental groups on the aquisition of geography terms'

definitions recalled on the day of instruction. An ANOVA was used to analyze the daily data using an average student score for the week from each of the 4 weeks of the study for the three conditions. The first hypothesis is rejected for the daily written measures on the 12 words targeted for each week.

Repeated measures analysis of variance tests of hypotheses for between subjects effects revealed a group effect on daily quizzes averaged across weeks [$F(2,66) = 26.97$; $p = .0001$]. A summary table for these results is found in Table 4-4. Repeated measures ANOVA tests of hypotheses for within subjects effects produced significant within subject effects. Significance was detected by a weekly effect averaged across groups ($F = 8.45$, $df = 3$, $p < .05$) and a difference in group effect across weeks ($F = 3.53$, $df = 6$, $p < .05$). The within subjects effect is important in the repeated measures design because it is the interaction between time of measurement and treatment that is of interest. Results are summarized in Table 4-5.

A general linear models procedure revealed significance between the groups and the daily quizzes for each of the 4 weeks of the study: Week 1 [$F(2,66) = 26.78$; $p = .0001$]; Week 2 [$F(2,66) = 9.35$; $p = .0003$]; Week 3 [$F(2,66) = 10.61$; $p = .0001$]; and Week 4 [$F(2,66) = 26.24$; $p = .0001$]. A summary table for these data is found in Table 4-6.

Table 4-4

Written Definitions of Daily Quizzes from 4 Weeks of Intervention for Between Subjects Effects (Acquisition)

Source	df	SS	MS	F	p
Method	2	34796.96	17398.48	26.97	.0001*
Error	66	42581.73	645.18		

*Significant at the $p < .05$ level

Table 4-5

Written Definitions of Daily Quizzes from 4 Weeks of Intervention for Within Subjects Effects (Acquisition)

Source	df	SS	MS	F	p	Adj. H-F p
Time	3	3846.25	1282.08	8.45	.0001*	.0001*
Time X Method	6	3215.07	535.85	3.53	.0024*	.0029*
Error (Time)	198	30040.44	151.72			

(H-F: The Huynh-Feldt correction for the F value was performed.)

*Significant at the $p < .05$ level

The Huynh-Feldt correction to the F ratio was executed for the within subjects effects to account for unequal variances and covariances among the treatment groups across the weeks. This correction helps to control the Type I error rate from violating the sphericity assumption.

A follow-up analysis of the means was performed using the following formula to conduct a multiple comparison procedure to find out where the significant differences

Table 4-6

Summary Table for General Linear Models Procedure for Daily Quizzes

Source	df	SS	MS	F	P
Quiz Week 1:					
Method	2	12017.70	6008.85	26.78	.0001*
Error	66	14810.37	224.40		
Quiz Week 2:					
Method	2	6497.01	3248.50	9.35	.0003*
Error	66	22921.46	347.29		
Quiz Week 3:					
Method	2	5592.69	2796.34	10.61	.0001*
Error	66	17402.56	263.68		
Quiz Week 4:					
Method	2	13904.63	6952.32	26.24	.0001*
Error	66	17487.78	264.97		

*Significant at the $p < .05$ level

existed among the main effects. The F was used at $p = .01$ to reduce the Type I error rate.

$$F = \frac{(\bar{X}_1 - \bar{X}_2)^2}{\frac{1}{(n_1 + n_2)} MS (\text{residual})}$$

There were significant differences for acquisition of definitions in favor of the mnemonic keyword versus the contextual analysis condition. However, the rote free-study subjects statistically outperformed subjects in both the mnemonic keyword in week 3 and in the contextual analysis

condition for all 4 weeks of intervention. A summary table for these data is found in Table 4-7.

Table 4-7
Results of Multiple Comparisons

Source	Means		F
Mnemonic (G_1) vs. Contextual (G_2)	(G_1)	(G_2)	
Week 1	31.50	13.31	30.01*
Week 2	34.28	23.50	11.57*
Week 3	21.30	14.53	4.32
Week 4	38.11	9.90	77.84*
Mnemonic (G_1) vs. Rote (G_3)	(G_1)	(G_3)	
Week 1	31.50	39.23	6.38
Week 2	34.28	41.90	5.87
Week 3	21.30	32.46	12.75*
Week 4	38.11	41.71	.98
Contextual (G_2) vs. Rote (G_3)	(G_2)	(G_3)	
Week 1	13.31	39.23	67.39*
Week 2	23.50	41.90	39.02*
Week 3	14.53	32.46	35.78*
Week 4	9.90	41.71	83.00*

*Significant at the $p < .01$ level to reduce error rate.

Hypothesis 2

The second hypothesis was that there would be no statistically significant differences among the three experimental groups on short-term retention of geography terms' definitions recalled at the end of the week following instruction. The second hypothesis is rejected for the written measures containing the 48 targeted terms from the 4

weeks of intervention: Week 1 [$F(2,41) = 10.92$; $p = .0002$]; Week 2 [$F(2,41) = 17.50$; $p = .0001$]; Week 3 [$F(2,41) = 11.06$; $p = .0001$]; and Week 4 [$F(2,41) = 7.24$; $p = .002$].

Repeated measures analysis of variance (ANOVA) tests of hypotheses for between subjects effects revealed a group effect on weekly tests averaged across weeks [$F(2,41) = 14.71$; $p = .0001$]. A summary table for these results is found in Table 4-8. Repeated measures ANOVA tests of hypotheses for within subjects effects also revealed that the weeks significantly differed when averaged across groups. However, there were no interaction effects or differences in group effect, across weeks. A summary table for these data is found in Table 4-9. The Huynh-Feldt correction to the F ratio was again conducted for within subjects to account for unequal variances and covariates among the groups across the weeks.

Table 4-8

Written Definitions of Weekly Tests from 4 Weeks of Intervention for Between Subjects Effects (Short-Term Retention)

Source	df	SS	MS	F	p
Method	2	12063.97	6031.97	14.71	.0001*
Error	41	16815.32	410.13		

*Significant at the $p < .05$ level

Table 4-9
Written Definitions of Weekly Tests from 4 Weeks of
Intervention for Within Subjects Effects (Short-Term
Retention)

Source	df	SS	MS	F	p	Adj. H-F
Time	3	3	6383.28	2127.76	.0001*	.0001*
Time X Method	6	927.44	154.57	1.91	.0839	.123
Error (Time)	123	9940.43	80.82			

(H-F: The Huynh-Feldt correction for the F value was performed.)

*Significant at the $p < .05$ level

A Tukey's Studentized Range (HSD) Test for variable follow-up analysis was performed to test where the significant differences existed among the main effect means. There were significant differences for short-term recall of definitions in favor of the mnemonic keyword versus the contextual analysis condition for the first 2 weeks of instruction and the rote free-study versus the contextual analysis condition throughout the 4 weeks of instruction. No statistical differences existed between performance of subjects in the keyword mnemonic and rote free-study conditions. A summary for these data is found in Table 4-10.

Hypothesis 3

The third hypothesis was that there would be no statistically significant differences among the three experimental groups on long-term retention of geography

Table 4-10
Results of Tukey's HSD Comparison

Source	Difference Between Means	Upper Confidence Level
Mnemonic (G ₁) vs. Contextual (G ₂)		
Week 1	10.26	17.95*
Week 2	10.74	19.33*
Week 3	13.67	28.81
Week 4	12.35	28.53
Week 7	8.04	29.57
Mnemonic (G ₁) vs. Rote (G ₃)		
Week 1	-1.10	7.13
Week 2	-7.81	.26
Week 3	-11.09	3.14
Week 4	-10.60	4.61
Week 7	-22.26	12.02*
Contextual (G ₂) vs. Rote (G ₃)		
Week 1	-10.35	-2.06*
Week 2	-18.56	-9.30*
Week 3	-24.76	-8.43
Week 4	-22.95	-5.49
Week 7	-30.30	-7.08

*Significant at the $p < .05$ level

terms' definitions recalled 2 weeks following instruction.

The third hypothesis is also rejected for the written measures containing the 48 targeted terms two weeks after instruction [$F(2,79) = 4.49$; $p = .0142$]. The summary of the general linear models procedure for these data is found in Table 4-11.

Table 4-11

Written Definitions of 48 Targeted Terms from Week 7 (Long-Term Retention)

Source	df	SS	MS	F	p
Method	2	3076.16	1538.08	4.49	.0142*
Error	79	27032.15	342.18		

*Significant at the $p < .05$ level

A Tukey's Studentized Range (HSD) Test for variable follow-up analysis showed a significant difference between subjects in the rote free-study method and the two other conditions. No other significant differences existed for subjects' long-term recall of the targeted definitions.

All three of the hypotheses were rejected at the .05 level of significance. Differences were found among the three experimental groups on acquisition, short-term retention, and long-term retention of geography terms. Statistical analysis of the dependent variables was used to answer each of the identified research questions concerning the three instructional groups.

Descriptive Analysis of the Data

Daily Acquisition Description

During each week of intervention, subjects were instructed on 12 targeted words (see Appendix D for listing of targeted terms for each week). Immediately following

instruction on each of the 4 instructional days of the week, the subjects wrote as many of the 12 targeted terms' definitions as they could in a 5-minute period. Subjects in the rote free-study group recalled an average of 5 definitions correctly. Subjects in the keyword mnemonic condition recalled an average of 4 definitions correctly. Subjects in the contextual analysis method recalled an average of 2 definitions correctly. The results of daily quizzes averaged over each week of instruction are presented in Appendix L.

Increases in the number of terms correctly learned per day over the course of the four week instructional period were minimal. Subjects in the rote free-study condition had a faster rate of acquisition for targeted terms per day than subjects in the other two instructional conditions. Subjects in the keyword mnemonic condition acquired more definitional information per day than subjects in the contextual analysis condition. The most notable difference in the raw data for daily acquisition occurred in Week 4, rote free-study condition.

Weekly Short-Term Recall Description

On the fifth day of Weeks 1 through 3, subjects were given a weekly test instead of instruction. Week 4 was split due to the Thanksgiving holiday and consisted of 3 days instruction followed by 1 more day of instruction the

following week. The weekly test was given on the second day of the week. Subjects were allowed 30 minutes to write the definitions of the words. Subjects in the rote free-study group recalled an average of 12 definitions correctly of the 48 terms presented on the assessment. Subjects in the keyword mnemonic method recalled an average of 11 definitions correctly. Subjects in the contextual analysis condition recalled an average of five definitions correctly, less than half of subjects in either of the other two conditions. The mean raw scores for each week of intervention are included in Appendix L.

Two-Week Long-Term Recall Description

Two weeks after the last day of instruction, subjects were given a fifth form of the Geography Terms' Definition Device (see Appendix E for assessments given each week). Subjects were again given 30 minutes to write the definitions of the 48 targeted terms. Subjects in the rote free-study group averaged 14 definitions recalled correctly. Subjects in the keyword mnemonic method averaged 10 definitions recalled correctly. Subjects in the contextual analysis condition recalled 6 definitions correctly. The mean raw scores for the long-term recall measures are also listed in Appendix L.

Summary

Subjects in the rote free-study condition recalled significantly more than subjects in the other two conditions on acquisition and long-term recall of geography terms' definitions. Subjects in the keyword mnemonic condition recalled significantly more definitions than subjects in the contextual analysis condition for the first two weeks of vocabulary acquisition. No statistically significant difference was found between the mnemonic keyword and rote free-study groups on the short-term recall measures. Interpretation and discussion of these findings are presented in Chapter 5.

CHAPTER 5 DISCUSSION

The fifth chapter begins with a summary review of the study. The conclusions of the study and their consistency with the theoretical considerations related to previous research are presented. Statistical and descriptive discussions of each hypothesis are stated. The chapter is concluded with implications, problems, and limitations, and suggestions for further research.

Review of the Study

Purpose and Objective

The purpose of the study was to examine the effects of keyword mnemonics compared to both contextual analysis and rote free-study strategies for learning geography terms. The objective of the study was to determine the relative effectiveness of these three techniques in improving the vocabulary acquisition and retention of students identified as at risk for dropping out of school before graduation.

Literature Summary Related to Theoretical Considerations

To date, memory theory suggests that memory is a factor of attention that goes through stages or systems. These early memory theorists (Ellis, 1970; Peterson & Peterson, 1959; Waugh & Norman, 1965) consider rehearsal strategies as the means for which information is transferred through the

systems making retention of information possible. The current study provides a rote free-study condition in which rehearsal strategies were incorporated into instruction of the targeted terms. The subjects in this condition significantly outperformed subjects in both the mnemonic keyword and control conditions on acquisition, and delayed recall lending further empirical data to the theories concerning rehearsal strategies.

Most research related to memorization of vocabulary terms has compared one strategy of instruction to another (i.e., keyword mnemonic vs. contextual analysis or keyword mnemonic vs. directed rehearsal or keyword mnemonic vs. free-study). The research of Atkinson and Shiffrin (1968) provides further classification to the theory concerning the dimensions of the memory system. This research supports the theoretical belief that structural features include both the basic memory stores systems and the control processes involved in any rehearsal operations, coding procedures, and categorization strategies. The keyword mnemonic strategy is credited to Atkinson (1975) based on this memory theory suggesting the two dimensions of the memory system. As researchers uncovered deficits in memory as characteristic of many students with learning disabilities (LD) (Torgesen & Goldman, 1977), interventions developed that focused on LD students' purposive semantic encoding, and retrieval

processes. Research has demonstrated the mnemonic strategies general effectiveness, of which directly provides encoding and retrieval routes, to successfully improve LD students' memory systems.

Due to the lack of research on vocabulary strategies with at-risk adolescents, most of the literature reviewed addressed the effects of keyword mnemonics, contextual analysis, and directed rehearsal with other populations. Seven of the eight experiments reviewed reported significant differences in the dependent variable when the keyword mnemonic strategy was applied to students with mild learning disabilities. The one study having results of no difference with the keyword mnemonic strategy utilized an at-risk population as subjects (Fox, King, & Evans, 1987). Additional research on keyword mnemonic instruction has compared keyword mnemonic methods to contextual strategies. This research has utilized both mildly disabled and nondisabled populations. The results of these reviewed studies are inconsistent. Three of eleven experiments resulted in no difference in delayed recall between keyword mnemonic instruction and contextual analysis instruction (McDaniel & Pressley, 1989; McDaniel, Pressley, & Dunay, 1987). Performance of subjects on the dependent measure for long-term recall supports these findings. Subjects in the

mnemonic condition did not statistically differ from subjects in the contextual condition.

However, two of the eleven studies concluded that even though subjects in keyword mnemonic conditions performed statistically better than subjects in contextual conditions, subjects in the keyword mnemonic method did not have greater recall than subjects in the free-study control condition (McDaniel & Pressley, 1984; Pressley, Levin, & Miller, 1982). McDaniel and Pressley (1984) further examined these results in relation to low and high verbal abilities. These researchers studied college students with low-abilities and high-abilities based on subjects verbal Stanford Achievement Test (SAT) scores. Subjects in the keyword mnemonic condition with low-ability performed statistically better than the other conditions, but not the high-ability subjects. Pressley, Levin, and Miller (1982) also reported subjects in the free-study control condition recalled significantly more information than any of the context conditions. However, subjects in the keyword mnemonic condition performed statistically better from subjects in the control condition and all of the contextual conditions.

The remaining nine studies reviewed concluded that keyword mnemonic strategies resulted in statistically positive recall effects, including acquisition, short-term, and long-term recall (Condus, Marshall, & Miller, 1986;

Levin, McCormick, Miller, Berry, & Pressley, 1982; McDaniel & Pressley, 1984, 1989; McDaniel, Pressley, & Dunay, 1987; McDaniel & Tillman, 1987). Results of this study are inconsistent with these findings. Condus et al. (1986) did not provide a consistent amount of instructional time per word for each condition. Control subjects were read the targeted term and the term's definition one time. Subjects were given a pencil and piece of paper and told to study the word independently. Unlike subjects in the present study, these subjects received no instruction, and thus, performed significantly lower than the other condition students as post, maintenance, and follow-up measures. The control group in the present study received the same amount of instructional time per targeted term as the other two conditions in the study. Subjects in the rote free-study condition recalled significantly more than subjects in the keyword mnemonic or contextual analysis condition on acquisition and long-term recall. A statistical difference was found between subjects in the keyword mnemonic condition and subjects in the contextual analysis condition for the first two weeks of vocabulary acquisition, but no statistically significant difference was found on the short-term recall measures between the mnemonic keyword and rote free-study groups.

Even though Condus et al. (1986) have improved research efforts for investigating the keyword mnemonic strategy as compared to alternative strategies for acquisition and maintenance of vocabulary terms, one must view these findings cautiously. First, the vocabulary words chosen for this study were words that contained concrete keywords that were easily identified. Targeted terms for the present study were identified by content social studies teachers for their relevance to the curriculum instead of their adaptability to a particular strategy. If words are specifically picked to favor one of the treatment conditions, then all conditions are not equal from the start. Second, instruction relative to each condition differed even though time spent learning the words remained constant in the Condus et al. (1986) study. The keyword mnemonic subjects received explicit instructions on that strategy. Subjects in neither context condition received instruction on using a contextual approach. Both context conditions, the picture context and the sentence-experience context, were simply presented information about the targeted term and no how to use the strategy. Subjects in the present study received specific instruction on using the strategy for each condition. The findings of the present study may be less dramatic for the keyword mnemonic subjects than the Condus et al. (1986)

keyword mnemonic subjects due to more equivalent strategy training throughout the treatment conditions.

Research has demonstrated the general effectiveness of keyword mnemonics, presented for vocabulary and content learning, as an effective means for acquiring and recalling information with college students, elementary students, and mildly disabled adolescents. None of the populations researched included the effects of keyword mnemonics, contextual analysis, and rote free-study on the performance of at-risk adolescents.

Hypothesis 1

The first null hypothesis was that there would be no statistical difference among the three treatment groups on daily rate of learning the targeted geography terms. This daily rate of learning was referred to as acquisition of definitions. The subjects' recall on the written measure with the 12 words targeted for each week indicated a significant difference for subjects in the three groups. Subjects in mnemonic condition acquired daily targeted definitions significantly better than subjects in the contextual condition throughout the 4 weeks of intervention. Subjects in the rote free-study condition learned significantly more definitions daily than subjects in the mnemonic condition for the first 3 weeks of intervention and performed significantly better than subjects in the

contextual condition throughout the 4-week intervention period.

Hypothesis 2

The second hypothesis was that there would be no statistical difference among the three experimental groups at the end of the week, after 4 days of instruction. This recall was referred to as short-term retention. The subjects' recall on the weekly measures for the 48 targeted terms resulted in significant differences between conditions. Subjects in both the keyword mnemonic and rote free-study conditions performed better than subjects in the contextual analysis method. The subjects in the rote free-study control condition recalled significantly more definitions than subjects in the contextual analysis method after each week of intervention. Subjects in the keyword mnemonic condition recalled significantly more definitions than subjects in the contextual analysis group after instruction the first 2 weeks.

Hypothesis 3

The third hypothesis was that there would be no statistical difference among the three experimental groups 2 weeks following instruction. This recall was referred to as long-term retention. The subjects recall on the definitions of the 48 targeted terms indicated significant results for subjects in the rote free-study condition. There were no

other significant results for the subjects' recall on the written measure for long-term retention of targeted definitions.

Subjects in all treatment conditions did improve vocabulary knowledge of the targeted terms throughout the study. The significant results obtained by subjects in rote free-study and keyword mnemonic conditions adds to the existing literature that supports the effectiveness of the rote free-study and keyword mnemonic methods when compared to contextual analysis methods. Additionally, the significant results obtained during the 7th week, two weeks after the end of instruction (long-term retention), for the rote free-study condition versus the two other conditions are an indication of previously unexplored effectiveness of rehearsal strategies for at-risk adolescents.

Summary of Method

Ninety-eight at-risk 7th grade students, 11 to 15 years of age, in four public middle schools served as subjects in the study. Due to the nature of the population, all subjects were not present for all dependent measures. See Table 5-1 for a summary of the number of subjects available for dependent measures. Researchers studying the keyword mnemonic method with mildly disabled subjects (Fox et al., 1987; Mastropieri et al., 1992; Mastropieri, Scruggs, & Fulk,

Table 5-1
Number of Subjects Available for Dependent Measures

Week	1	2	3	4	7
<u>Condition</u>					
Mnemonic Keyword					
Quiz	28	27	27	27	
Test	25	26	25	23	23
Contextual					
Quiz	27	34	32	33	
Test	18	17	27	26	27
Rote Free-Study					
Quiz	35	36	36	20	
Test	32	32	33	18	32
Total					
Quiz	90	97	95	80	
Test	75	75	85	67	82

1990; McLoone et al., 1986; Scruggs & Mastropieri, 1989, 1992; Veit et al., 1986) have examined the success of keyword mnemonics with the adolescent population. However, most researchers comparing the keyword mnemonic method with contextual analysis methods (McDaniel & Pressley, 1984, 1989; McDaniel, Pressley, & Dunay, 1987; McDaniel & Tillman, 1987; Pressley, Levin, & Miller, 1982) used introductory psychology students in college courses. These later researchers had brief instructional sessions that usually lasted for only one session. Conduis et al. (1986) was the only researcher who compared the keyword mnemonic method to contextual methods using adolescents as subjects, while Levin et al. (1982) were

the only researchers who studied elementary students' usage of mnemonic and contextual methods. Unlike Conodus et al. (1986) who randomly assigned subjects to one of four treatment conditions, a classroom-based research design allowed for the random assignment of treatment conditions to existing classrooms in the present study. Each condition was randomly assigned to two different existing alternative education classrooms. The repeated measures design allowed for comparisons of the three group means to be analyzed to determine if there were significant differences among the three treatment groups over time: daily, end of each week, and 2 weeks after instruction. The rote free-study group served as the control condition, while the keyword mnemonic group and contextual analysis condition served as intervention conditions. The experiment was divided into four phases: (a) survey and screening; (b) teacher training; (c) instructional; and (d) measurement.

Social Study teachers were surveyed to obtain an appropriate selection of targeted terms from two Florida, state adopted geography texts. Surveyed teachers marked any geography term they thought was not appropriate or necessary for the 7th grade geography curriculum. Results of the survey were tallied and any term receiving at least 15 tallies was omitted. A total of 24 words were omitted leaving 66 words appropriate for the study. Information was

also gathered from the survey regarding each teacher's years experience teaching geography and expectations for geography term acquisition for 7th graders. Thirty-six teachers responded. Teachers experience ranged from 0 years to 20 plus years. Twenty-three of the responding teachers were currently teaching geography. Teachers varied in the number of terms students should learn per week. Twelve terms per week was the average number stated by those surveyed. Forty-eight terms were randomly assigned to one of four weeks of instruction. Three terms were chosen for demonstration words from the remaining 18 terms for the beginning of each instructional week (see Appendix C for specific results of the survey).

Students were screened to determine any prior knowledge of geography terms. All subjects screened knew less than 12 of the 90 terms and met eligibility for participation in the study. Additionally, students were required to commit themselves to try their best throughout the study. Even though every subject signed a written statement, the population of at-risk subjects adds to problems with experimental control (e.g., absenteeism, motivation, self-esteem).

The second phase of the study focused on teacher training. The teacher training phase occurred prior to the implementation of the strategies and was conducted

individually for each teacher. Teachers were randomly assigned to each strategy condition. Teachers of the alternative classrooms in Orange County ranged from 3 years teaching experience to 17 years teaching experience. Teachers in the keyword mnemonic condition had 9 years teaching experience collectively. Teachers in the contextual analysis condition had 32 years teaching collectively. Teachers in the rote free-study condition had 10 years teaching experience collectively. Teachers were instructed on the basic components of effective teaching. These components of "All Right, My Great Students Really Can Excel" (see Appendix G for a complete description) were common to all intervention groups. Teachers followed a demonstration and then practiced these techniques. Questions or concerns were also addressed.

Each teacher was given a packet of material and teaching script to use for the first 2 weeks of instruction. Teachers reviewed these materials and scripts and demonstrated the use of their assigned strategy. After teachers felt proficient, they scheduled a demonstration observation where they role-played the steps of their intervention while two observers rated the teacher (see Appendix H for Time Sampling Recording Form). Teachers demonstrated the ability to implement correctly the scripted lesson formats. Interobserver agreement during this phase was 95%. This investigator

provided support and reinforcement for the six teachers who participated in this study throughout the investigation. Each week teachers received either a thank-you memo from the Director of Alternative Programs and the investigator, or pens, note pads, and stickers. A personal note of appreciation was also given to each teacher for their participation in the investigation and formal letter of appreciation was sent to each teacher's principal recognizing the teacher's participation.

Although all teachers demonstrated appropriate use of materials and lesson formats, periodic checks throughout the implementation phase revealed some teachers did not follow the prescribed procedures consistently. Observers found on two different occasions with two different teachers, no usage of the timing timer required for pacing. However, observers noted that pacing was consistent and at appropriate intervals. Another observation period revealed one of the teachers in the keyword mnemonic condition did not follow the proper sequence of instructional steps provided on the scripted lesson.

The instructional implementation phase consisted of 4 weeks. During each of the 4 weeks, 12 different targeted geography terms were randomly assigned for instruction. Students received instruction for 4 days, and then were tested on the 5th day. The Daily Written Geography

Definition Device was the variable used to measure the rate students were acquiring knowledge of the 12 targeted definitions for each week. Teachers reported students complained about only having 5 minutes to complete the daily quizzes during the first 2 weeks of instruction, but complaints lessened during the remaining two weeks of the study. The Weekly Written Geography Terms Definition Device measured short-term retention at the end of the week of instruction. Long-term retention was measured by this same device 2 weeks following the end of instruction. Although words were frequently misspelled on the dependent measures, spelling of the definitions was not a factor. However, handwriting was a factor on three occasions because it was not legible.

Discussion and Implications

Results of the study, across the 4 weeks of intervention and long-term follow-up, were significant in relation to the stated objective. The most significant effect was obtained for the rote free-study group of subjects on daily acquisition rates and long-term definition recall. This significant effect for the rote free-study group of at-risk adolescents may have occurred because these students have previously been exposed to this method in their prior school experiences, and therefore, had to put forth little effort to practice the strategy. Conversely, students in the other two

conditions had to learn a method that they were unfamiliar with and may have been less motivated to put forth the extra effort necessary to learn a new strategy.

In addition, the keyword mnemonic subjects produced significant results over the contextual analysis subjects during acquisition and on the first 2 weeks of short-term retention measures. Subjects in these two groups may have performed better than subjects in the contextual analysis condition because definitions were provided rather than inferred from the text. Many words have numerous meanings. Students would sometimes write a definition to a term that was a correct response for a homonym, but not for the targeted geography term. For example, the term "maize" meaning Indian corn, may have been defined as "maze" something with many blockades difficult to get out of. Furthermore, subjects in the contextual analysis condition lacked all necessary components to get full credit for a complete response. Partial credit was not awarded. Subjects in the contextual analysis group would many times write part of a definition (e.g., "gaucho" a cowboy -incorrect versus a South American cowboy -correct). Previous studies comparing the contextual analysis procedure to the keyword mnemonic have included both the specific definition with the context material (McDaniel & Pressley, 1989; McDaniel, Pressley, & Dunay, 1987) and required subjects to infer the terms'

meanings from the provided context without providing a specific definition (Condus et al., 1986; McDaniel & Pressley, 1984; McDaniel, Pressley, & Dunay, 1987; McDaniel & Tillman, 1987). These researchers found subjects performed significantly better in the keyword mnemonic condition on acquisition and short-term recall, whether the definition was provided or inferred in the contextual condition. However, McDaniel, Pressley, and Dunay (1987) found both groups performed equivalently 1 week after instruction when the contextual analysis group was provided a definition. The results in the present study of measuring performance 2 weeks after instruction provided similar results. Although subjects in the keyword mnemonic condition recalled more definitions than subjects in the contextual analysis group, on the long-term measures the difference was not significant. Subjects in the keyword condition could only remember the keyword for the definition. It appears to this investigator that the subjects who were only recalling the keywords were not successfully using the three Rs of Levin's (1983) theory: recording unfamiliar words into familiar words, relating the familiar words to the definition of the unfamiliar words, and retrieving the definition of the unfamiliar word by using the recorded keyword. These students could recode the targeted term, but had difficulty relating the keyword to the definition and retrieving the definition of the targeted

term. More time may have been necessary rehearsing these interactive components. Also, student-generated interactive images may have produced significant results as found in studies with college students (McDaniel & Pressley, 1984, 1989; McDaniel & Tillman, 1987; Pressley, Levin, & Miller, 1982).

The finding of the keyword mnemonic subjects recalling significantly more definitions than contextual analysis subjects in the first 2 weeks of instruction is interesting. The last 2 weeks of instruction were interrupted by the Thanksgiving holidays. Various special school and community activities may have affected the subjects' daily routine and consistency of instructional procedures. Most researchers examining the effect of the keyword mnemonic strategy have only studied subjects for short durations of either 1 day (Levin et al., 1982; Mastropieri, Scruggs & Fulk, 1990; McLoone et al. (1986; McDaniel & Pressley, 1984, 1989; McDaniel & Tillman, 1987; Pressley et al., 1982), 3 days (Veit et al., 1986), or 1 week (McDaniel, Pressley, & Dunay, 1987). Few researchers have examined the effect of the keyword mnemonic strategy for 4 weeks or more (Condue et al., 1986; Fox et al., 1987; King-Sears et al., 1992; Mastropieri et al., 1992; Scruggs & Mastropieri, 1992). Researchers need to examine teaching strategies in realistic settings, using realistic curriculum and assessed over a long enough period

of time to be able to determine the effect of the strategy in a functional setting.

Problems and Limitations

There were a number of problems and limitations that were encountered in the process of implementing this research study which should be considered when interpreting these data. First, classroom-based research loses some experimental control. Under actual classroom conditions, instruction was not always delivered precisely as intended. Subject attrition and interference (e.g., office referrals, suspensions, other activities) restricted experimental conditions, time of day constraints, and teacher variables all may have contributed to differences in experimental and control conditions. The problem could have been alleviated by increasing the random assignment of perhaps 10 to 20 classrooms per condition to treatment conditions. However, this increase in population is more difficult to set-up and monitor.

Randomly assigning existing classrooms to treatments may also present a limitation. Students have different teachers with different styles. A within-subject design, in which each student receives each treatment, in counter-balanced order, and therefore serves as his or her own experimental control might help to address this concern. Again, this solution presents a new problem of confounding variables.

One strategy condition may "carry over" or transfer into the next.

Suggestions for Further Research

Results of the present study were generally conclusive; however, it is suggested that future replications be done to establish the validity of the findings. Trends in research suggest improvement in the recall of definitions for adolescents with mild disabilities receiving keyword mnemonic methods of instruction, while the present study did not. The difference suggests that the subject populations may learn information differently. Therefore, the effectiveness of the keyword mnemonic strategy may depend on the specific deficit areas encountered by the varying populations. Another suggestion would be to take students who are learning disabled and at-risk students and measure them on definition acquisition and recall using the same methods of this study.

In future research, the design considerations for classroom-based research should consider a within-subject design with careful planning of treatment orders and strategy questioning. Video-taping instructional sessions would also help to monitor conditions in a within-subjects design or in a replication of the present study.

Since the contextual analysis condition was not provided with a definition of the targeted term and the definition had to be inferred from text, an additional condition could be

examined that would receive the same definition as the other conditions embellished into the text. Another condition that could be added is a rote free-study condition receiving only the definition of the targeted term without a picture. Pictorial effects could begin to be examined by this additional condition.

These and other related findings of the present investigation are important to teachers of at-risk adolescents, but are only a portion of the numerous and complex contributing factors affecting at-risk students' ability to achieve academically and socially. A variety of factors must be examined and addressed in addition to specific strategy training: (a) motivation; (b) physical and emotional health; (c) quality of teaching; (d) time for learning; (e) availability of appropriate instructional materials; and (f) relevance of the curriculum. Attention should be given not only to how the curriculum is being delivered to at-risk adolescents, but also the curriculum itself. Functional relevant curriculum is necessary. It is not sufficient simply to teach content information by reiteration and memory strategies even though most assessment methods measure these skills. Rather, content information needs to be taught along with higher order thinking skills such as illustration, evaluation, prediction, and application.

In summary, serving at-risk students in the public education system presents a difficult challenge. The at-risk students who participated in this investigation benefited from all vocabulary methods. The students in the rote free-study condition learned more than the students in the other conditions on the acquisition and long-term recall measures. The students in the keyword mnemonic condition learned more than the students in the contextual analysis condition on the acquisition and first 2 weeks of short-term retention measures. These and other related findings of the present investigation are important to teachers of at-risk adolescents. A systematic approach to classroom-based research is needed to provide further information beyond the scope of this study. Such research would take the present study a step closer to providing practical information for teachers of at-risk students.

APPENDIX A
LISTING OF WORDS USED DURING SCREENING

animism
apartheid
archipelago
artesian well
atmosphere
atoll
axis
bartering
biosphere
Boers
boundary
boycott
cacao
canyon
cape
carabao
cinchona
compost
condensation
contiguous
continent
copra
cove
crust
czar
delta
detente
dhoti
dike
dingo

divide
drought
earthquake
elevation
equator
erosion
escarpment
estancia
evaporation
fault
fazenda
fjord
foothills
gaucho
hemisphere
hieroglyphics
isthmus
junks
jute
karma
kibbutz
Lapp
latitude
leaching
leeward
loess
longitude
maize
manioc
meridian

mesa
Nihon
nomads
oasis
obi
paddy
pagoda
peninsula
permafrost
plateau
precipitation
rajahs
savanna
serfs
sheif
sisal
souk
steppe
taiga
thresh
titanium
tributary
tsunami
tundra
veto
wat
yoke
yurt
zebu
zemindars

1. animism - a belief that all things including lifeless objects (such as rocks) have souls that may exist apart from the object
2. apartheid - policy of separating people of different races in the Republic of South Africa
3. archipelago - any large group of islands
4. artesian well - well dug deep in the earth through a layer of rock that causes the water to shoot to the surface
5. atmosphere - "blanket" of air that surrounds the Earth
6. atoll - small coral island with a body of water at its center; most often found in the South Pacific
7. axis - an imaginary line through the earth at its poles and upon which the earth spins
8. bartering - the direct trading of one kind of goods for another, with no use of money
9. biosphere - the part of the Earth and atmosphere where life can exist
10. Boers - Dutch settlers in South Africa
11. boundary - the place where a country's land ends
12. boycott - refusal to buy goods
13. cacao - tropical plant, from the seeds of which cocoa and chocolate are made
14. canyon - a very narrow valley with steep sides
15. cape - a part of the land that extends into an ocean or lake
16. carabao - a water buffalo
17. cinchona - bark of tree that grows in the rain forests of South America and Asia; used in making quinine
18. compost - mixture of decaying organic matter (garbage, manure, leaves)
19. condensation - the process of changing from water vapor to water droplets
20. contiguous - sharing an edge or boundary

21. continent - one of the seven largest bodies of land on Earth: North America, South America, Asia, Africa, Europe, Australia, and Antarctica
22. copra - dried "meat" or pulp of a coconut
23. cove - a small bay
24. crust - the layer of rock beneath the continents and oceans
25. czar - ruler of Russia before 1917
26. delta - the soil deposited at the mouth of a river
27. detente - a relaxing of tension between nations
28. dhoti - a loincloth worn by some Hindu men
29. dike - small mud wall built to control the flow of water in a rice field
30. dingo - a reddish or yellowish brown wild dog of Australia
31. divide - a ridge or highland area between two lower areas
32. drought - a long dry spell
33. earthquake - terrible shaking of the ground
34. elevation - height above sea level or above the surface of the earth
35. equator - imaginary line around the middle of the earth, halfway between the North and South Poles
36. erosion - wearing away of the soil through the action of wind, water, or glaciers
37. escarpment - a steep slope or cliff that separates two areas with different elevations
38. estancia - large piece of land or cattle ranch in Latin America
39. evaporation - process by which water is changed into water vapor
40. fault - a weak place in the Earth's crust
41. fazenda - Brazilian coffee plantation
42. fjord - narrow inlet of the sea surrounded by steep cliffs, found especially in Norway
43. foothills - the hills at the base of a mountain range

44. gaucho - cowboy of the South American pampas
45. hemisphere - half the earth or globe
46. hieroglyphics - an Egyptian way of writing in which picture symbols stand for words, sounds, or ideas
47. isthmus - narrow strip of land joining two larger bodies of land
48. junks - large, flat-bottomed boats; used to carry goods in China
49. jute - plant fiber used in making rope and burlap bags
50. karma - according to Hindu belief, the behavior of people that brings them results, either good or bad, either in this or a future life; fate
51. kibbutz - farming community in Israel owned by the people who live and work on its land
52. Lapp - person who lives and herds reindeer in the tundra region of northern Europe
53. latitude - imaginary lines running east and west around the earth and parallel to the equator; they measure in degrees the distance north and south of the equator
54. leaching - washing out minerals or nutrients from the soil
55. leeward - away from the wind; the side of mountains that receives less rain
56. loess - fine yellow dust or soil found in the Huang River Valley in China and in parts of the Mississippi River Valley
57. longitude - imaginary lines running north and south from Pole to Pole; they measure in degrees the distance east or west of the prime meridian that passes through Greenwich, England
58. maize - Indian corn
59. manioc - starchy food of a tropical plant, made into a bread by rain-forest peoples; also called cassava
60. meridian - line of longitude
61. mesa - a high land form, with a flat top and steep rock walls

62. Nihon - a Japanese name for Japan
63. nomads - people who wander from place to place in search of better grazing land for their flock or herd
64. oasis - desert land where water can be found and some crops can be grown
65. obi - a long, broad sash or cloth belt tied around the waist of Japanese kimono
66. paddy - small rice field, enclosed by dikes of mud
67. pagoda - an Asian temple or sacred building; it is usually shaped like a pyramid or forms a tower with upward-curving roofs over the individual stories
68. peninsula - a piece of land almost entirely surrounded by water
69. permafrost - soil just below the earth's surface in Arctic regions that never thaws or melts
70. plateau - large area of level highland, not so rough as mountains
71. precipitation - any form of rain or snow; rain, snow, sleet, or hail
72. rajahs - princes or rulers of ancient India
73. savanna - hot climatic region of two seasons, rainy and dry, found north and south of the tropical rain forests
74. serfs - people who work for a lord or a large landowner, and who are bound to their lord's land and sold with it to any new owner
75. sheif - head man of a village or a tribe, chiefly in the Middle East
76. sisal - a fiber used for making rope and rugs
77. souk - an Arab market, or bazaar
78. steppe - large treeless plain that has cold winters and hot summers, and receives from 10 to 20 inches of rain a year; called a prairie in the United States
79. taiga - large cold forests of subarctic regions
80. thresh - to separate the grain or seeds from the rest of a plant

81. titanium - a metal with many uses. Because it is strong and light it is used in aircraft and jet engines
82. tributary - branch of a river
83. tsunami - an unusually large sea wave produced by a quake or undersea volcano; "tidal wave"
84. tundra - level, treeless region of the Arctic that has long, severe winters and short summers. The ground is frozen nearly all year
85. veto - power to prevent an action by refusing to agree
86. wat - a Buddhist temple
87. yoke - a wooden frame used to fasten two work animals together
88. yurt - a circular tent made of goat skins; used by Mongol nomads
89. zebu - an ox-like animal with a large hump over the shoulders
90. zemindars - in India, a large landowner

APPENDIX B
WRITTEN GEOGRAPHY TERM DEFINITION SCREENING DEVICE

Written Geography Term Definition Screening Device

Student _____ Date _____

Teacher _____ Score _____

Directions: Find the words you know and write the definition next to the word.

1. animism _____

2. apartheid _____

3. archipelago _____

4. artesian well _____

5. atmosphere _____

6. atoll _____

7. axis _____

8. bartering _____

9. biosphere _____

10. Boers _____

11. boundary _____

12. boycott _____

13. cacao _____

14. canyon _____

15. cape _____

16. carabao _____

17. cinchona _____

18. compost _____

19. condensation _____

20. contiguous _____

21. continent _____

22. copra _____

23. cove _____

24. crust _____

25. czar _____

26. delta _____

27. detente _____

28. dhoti _____

29. dike _____

30. dingo _____

31. divide _____

32. drought _____

33. earthquake _____

34. elevation _____

35. equator _____

36. erosion _____

37. escarpment _____

38. estancia _____

39. evaporation _____

40. fault _____

41. fazenda _____

42. fjord _____

43. foothills _____

44. gaucho _____

45. hemisphere _____

46. hieroglyphics _____

47. isthmus _____

48. junks _____

49. jute _____

50. karma _____

51. kibbutz _____

52. Lapp _____

53. latitude _____

54. leaching _____

55. leeward _____

56. loess _____

57. longitude _____

58. maize _____

59. manioc _____

60. meridian _____

61. mesa _____

62. Nihon _____

63. nomads _____

64. oasis _____

65. obi _____

66. paddy _____

67. pagoda _____

68. peninsula _____

69. permafrost _____

70. plateau _____

71. precipitation _____

72. rajahs _____

73. savanna _____

74. serfs _____

75. sheif _____

76. sisal _____

77. souk _____

78. steppe _____

79. taiga _____

80. thresh _____

81. titanium _____

82. tributary _____

83. tsunami _____

84. tundra _____

85. veto _____

86. wat _____

87. yoke _____

88. yurt _____

89. zebra _____

90. zemindars _____

APPENDIX C
TEACHER SURVEY TO EVALUATE CONTENT VALIDITY

Teacher Survey to Evaluate Content Validity

Teacher _____ School _____

Date _____

Years Experience Teaching Geography ____0 ____1-4 ____5-10
____11-15 ____16-20
more than 20 ____

Please take a moment to fill out the following survey. I am completing a study of effective teaching strategies for use with at-risk adolescents. Your information from your teaching experience is valuable for this study.

1. Are you teaching geography during the 1992-93 school year?
_____ yes _____ no
2. How many geography terms do you believe a student should master per week in order to be proficient in the curriculum? _____
3. Do you feel mastering geography terms is an important part of the 7th grade geography curriculum?
_____ yes _____ no

Please explain your answer: _____

4. Please look over the attached list of words and circle the words you feel are not necessary for a student to master in a 7th grade geography class.

Thank you for your time and input. I know this is a busy time of the school year and I appreciate your efforts. Please return this and the attached sheet by SEPTEMBER 4, 1992.

Return to:

Shirley Fox
Lee Middle School
via school courier mail

Results from Teacher Survey

Years of experience teaching geography:

0 yrs exp --- 9 teachers	1-4 yrs exp --- 11 teachers
5-10 yrs exp --- 5 teachers	11-15 yrs exp --- 4 teachers
16-20 yrs exp --- 2 teachers	20 + yrs exp --- 5 teachers

Teachers teaching geography during the 1992-93 school year:

23 tchrs --- teaching geography	13 tchrs --- not teaching geography
---------------------------------	-------------------------------------

Number of geography terms students need to master per week:

1-5 terms --- 9 tchrs	6-10 terms --- 14 tchrs
15-25 terms --- 3 tchrs	No Opinion --- 10 tchrs

Number of teachers who feel mastering geography terms important:

35 tchrs --- important	1 tchr --- No Opinion
------------------------	-----------------------

Teachers' response to word list.

Number beside word indicates the number of teachers who felt term was not necessary for students to master in 7th grade geography:

animism - 25	divide - 2	mesa - 3
apartheid - 4	drought - 1	Nihon - 28
archipelago - 2	earthquake - 0	nomads - 5
artesian well - 10	elevation - 0	oasis - 2
atmosphere - 1	equator - 0	obi - 28
atoll - 5	erosion - 0	paddy - 8
axis - 0	escarpment - 12	pagoda - 9
bartering - 8	estancia - 23	peninsula - 0
biosphere - 5	evaporation - 6	permafrost - 3
Boers - 17	fault - 3	plateau - 0
boundary - 0	fazenda - 22	precipitation - 0
boycott - 8	fjord - 1	rajahs - 23
cacao - 12	foothills - 2	savanna - 1
canyon - 0	gaucho - 13	serfs - 8
cape - 0	hemisphere - 0	sheif - 19
carabao - 28	hieroglyphics - 14	sisal - 15
cinchona - 25	isthmus - 0	souk - 23
compost - 9	junks - 14	steppe - 1
condensation - 6	jute - 12	taiga - 3
contiguous - 5	karma - 20	thresh - 11
continent - 0	kibbutz - 13	titanium - 12
copra - 17	Lapp - 14	tributary - 0
cove - 4	latitude - 0	tsunami - 16
crust - 4	leaching - 10	tundra - 1
czar - 13	leeward - 6	veto - 11
delta - 0	loess - 15	wat - 21
detente - 16	longitude - 0	yoke - 12
dhoti - 26	maize - 10	yurt - 21
dike - 5	manioc - 17	zebu - 24
dingo - 18	meridian - 1	zemindars - 27

APPENDIX D
DAILY MEASURE OF GEOGRAPHY TERMS' DEFINITION DEVICE

Daily Measure of Geography Terms' Definition Device

Student _____ Date _____

Teacher _____ Score _____

Directions: Find the words you know and write the definitions next to the words.

(This device had 12 selected geography terms to be defined for each week of training. Three demonstration words were taught each Monday prior to instruction of the 12 selected terms. These words were based on the results of the teacher survey. The words were divided randomly for each week of training.)

Demonstration Words

Week 1

biosphere
compost
crust

Week 2

divide
erosion
foothills

Week 3

cove
evaporation
pagoda

Week 4

czar
hieroglyphics
junks

Selected Terms for Strategy InstructionWeek 1

axis
cape
contiguous
drought
earthquake
escarpment
isthmus
latitude
oasis
plateau
precipitation
tributary

Week 3

apartheid
bartering
cacao
delta
hemisphere
jute
Lapp
leeward
mesa
savanna
steppe
veto

Week 2

atoll
atmosphere
boundary
condensation
continent
elevation
equator
fault
fjord
longitude
meridian
peninsula

Week 4

archipelago
boycott
canyon
dike
gaucho
kibbutz
leaching
maize
nomads
permafrost
serfs
taiga

Daily Measure of Geography Terms' Definition Device
(Day 1- Week 1)

Student _____ Date _____

Teacher _____ Score _____

Directions: Find the words you know and write the definitions next to the words.

1. cape _____
2. latitude _____
3. tributary _____
4. earthquake _____
5. plateau _____
6. isthmus _____
7. axis _____
8. precipitation _____
9. escarpment _____
10. contiguous _____
11. oasis _____
12. drought _____

Daily Measure of Geography Terms' Definition Device
(Day 2 - Week 1)

Student _____ Date _____

Teacher _____ Score _____

Directions: Find the words you know and write the definitions next to the words.

1. precipitation _____
2. contiguous _____
3. latitude _____
4. cape _____
5. earthquake _____
6. oasis _____
7. escarpment _____
8. isthmus _____
9. drought _____
10. axis _____
11. tributary _____
12. plateau _____

Daily Measure of Geography Terms' Definition Device
(Day 3 - Week 1)

Student _____ Date _____

Teacher _____ Score _____

Directions: Find the words you know and write the definitions next to the words.

1. earthquake _____
2. escarpment _____
3. axis _____
4. contiguous _____
5. oasis _____
6. plateau _____
7. isthmus _____
8. tributary _____
9. precipitation _____
10. cape _____
11. drought _____
12. latitude _____

Daily Measure of Geography Terms' Definition Device

(Day 4 - Week 1)

Student _____ Date _____

Teacher _____ Score _____

Directions: Find the words you know and write the definitions next to the words.

1. tributary _____
2. oasis _____
3. drought _____
4. escarpment _____
5. contiguous _____
6. earthquake _____
7. plateau _____
8. latitude _____
9. isthmus _____
10. precipitation _____
11. axis _____
12. cape _____

APPENDIX E
GEOGRAPHY TERMS' DEFINITION DEVICE

Geography Terms' Definition Device

Student _____ Date _____

Teacher _____ Score _____

Directions: Find the words you know. Write the definitions next to the words.

(This device has all the targeted geography terms used for instruction for all weeks of the study. There are five forms with the order of the words listed randomly on each form. Forty-eight words have been selected for instruction based on the results of the teacher survey and screening device.)

apartheid
archipelago
atmosphere
atoll
axis
bartering
boundary
boycott
cacao
canyon
cape
condensation
contiguous
continent
dike
drought

earthquake
elevation
equator
escarpment
fault
fjord
gaucho
hemisphere
isthmus
jute
kibbutz
Lapp
latitude
leaching
leeward
longitude

maize
meridian
mesa
nomads
oasis
peninsula
permafrost
plateau
precipitation
savanna
serfs
delta
steppe
taiga
tributary
veto

Geography Terms' Definition Device
(Week 1)

Student _____ Date _____

Teacher _____ Score _____

Directions: Find the words you know and write the definitions next to the words.

1. boycott _____

2. dike _____

3. gaucho _____

4. leaching _____

5. permafrost _____

6. veto _____

7. axis _____

8. maize _____

9. taiga _____

10. plateau _____

11. kibbutz _____

12. fjord _____

13. continent _____

14. elevation _____

15. atmosphere _____

16. oasis _____

17. escarpment _____

18. peninsula _____

19. condensation _____

20. apartheid _____

21. steppe _____

22. drought _____

23. latitude _____

24. serfs _____

25. cape _____

26. hieroglyphics _____

27. longitude _____

28. bartering _____

29. jute _____

30. meridian _____

31. precipitation _____

32. contiguous _____

33. earthquake _____

34. Lapp _____

35. archipelago _____

36. equator _____

37. savanna _____

38. canyon _____

39. nomads _____

40. fault _____

41. atoll _____

42. tributary _____

43. cacao _____

44. leeward _____

45. hemisphere _____

46. delta _____

47. isthmus _____

48. boundary _____

Geography Terms' Definition Device
(Week 2)

Student _____ Date _____

Teacher _____ Score _____

Directions: Find the words you know and write the definitions next to the words.

1. earthquake _____

2. oasis _____

3. dike _____

4. isthmus _____

5. meridian _____

6. continent _____

7. archipelago _____

8. peninsula _____

9. leaching _____

10. hemisphere _____

11. bartering _____

12. kibbutz _____

13. savanna _____

14. apartheid _____

15. veto _____

16. cacao _____

17. hieroglyphics _____

18. taiga _____

19. nomads _____

20. drought _____

21. maize _____

22. atoll _____

23. serfs _____

24. axis _____

25. contiguous _____

26. atmosphere _____

27. boycott _____

28. boundary _____

29. precipitation _____

30. elevation _____

31. delta _____

32. jute _____

33. fjord _____

34. escarpment _____

35. gaucho _____

36. leeward _____

37. longitude _____

38. plateau _____

39. Lapp _____

40. condensation _____

41. permafrost _____

42. steppe _____

43. equator _____

44. tributary _____

45. cape _____

46. canyon _____

47. latitude _____

48. fault _____

Geography Terms' Definition Device
(Week 3)

Student _____ Date _____

Teacher _____ Score _____

Directions: Find the words you know and write the definitions next to the words.

1. precipitation _____

2. contiguous _____

3. veto _____

4. apartheid _____

5. hemisphere _____

6. savanna _____

7. boycott _____

8. jute _____

9. cacao _____

10. tributary _____

11. continent _____

12. peninsula _____

13. latitude _____

14. atoll _____

15. permafrost _____

16. dike _____

17. isthmus _____

18. canyon _____

19. Lapp _____

20. axis _____

21. fault _____

22. plateau _____

23. taiga _____

24. elevation _____

25. boundary _____

26. gaucho _____

27. escarpment _____

28. hieroglyphics _____

29. maize _____

30. steppe _____

31. kibbutz _____

32. equator _____

33. leaching _____

34. atmosphere _____

35. cape _____

36. meridian _____

37. serfs _____

38. drought _____

39. bartering _____

40. leeward _____

41. archipelago _____

42. fjord _____

43. delta _____

44. oasis _____

45. condensation _____

46. longitude _____

47. earthquake _____

48. nomads _____

Geography Terms' Definition Device
(Week 4)

Student _____ Date _____

Teacher _____ Score _____

Directions: Find the words you know and write the definitions next to the words.

1. hemisphere _____

2. atoll _____

3. equator _____

4. precipitation _____

5. hieroglyphics _____

6. steppe _____

7. oasis _____

8. kibbutz _____

9. veto _____

10. boycott _____

11. isthmus _____

12. cacao _____

13. nomads _____

14. archipelago _____

15. meridian _____

16. cape _____

17. apartheid _____

18. plateau _____

19. fault _____

20. atmosphere _____

21. earthquake _____

22. boundary _____

23. longitude _____

24. permafrost _____

25. continent _____

26. axis _____

27. delta _____

28. savanna _____

29. bartering _____

30. peninsula _____

31. taiga _____

32. dike _____

33. Lapp _____

34. drought _____

35. fjord _____

36. leeward _____

37. elevation _____

38. tributary _____

39. latitude _____

40. gaucho _____

41. canyon _____

42. maize _____

43. contiguous _____

44. serfs _____

45. escarpment _____

46. leaching _____

47. jute _____

48. condensation _____

Geography Terms' Definition Device
(Week 7)

Student _____ Date _____

Teacher _____ Score _____

Directions: Find the words you know and write the definitions next to the words.

1. serfs _____

2. condensation _____

3. elevation _____

4. taiga _____

5. leaching _____

6. isthmus _____

7. tributary _____

8. savanna _____

9. contiguous _____

10. longitude _____

11. steppe _____

12. atmosphere _____

13. maize _____

14. dike _____

15. leeward _____

16. canyon _____

17. precipitation _____

18. cape _____

19. escarpment _____

20. plateau _____

21. boycott _____

22. atoll _____

23. Lapp _____

24. hieroglyphics _____

25. oasis _____

26. veto _____

27. hemisphere _____

28. archipelago _____

29. fjord _____

30. boundary _____

31. equator _____

32. drought _____

33. drought _____

34. axis _____

35. fault _____

36. permafrost _____

37. earthquake _____

38. continent _____

39. meridian _____

40. delta _____

41. peninsula _____

42. kibbutz _____

43. bartering _____

44. gaucho _____

45. nomads _____

46. cacao _____

47. apartheid _____

48. jute _____

APPENDIX F
EXAMPLES OF CARDS TO BE USED WITH EACH CONDITION

latitude

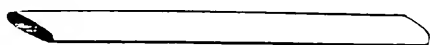
latitude

distance
north or
south of
the equator

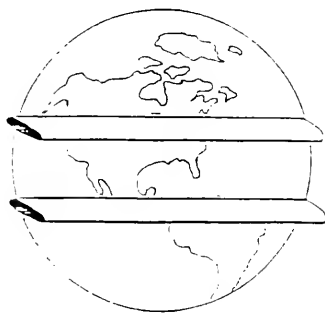


think

flat tube



latitude



latitude

latitude

The east-west lines on a map are lines of latitude. One of the imaginary lines of latitude that circle the earth is called the equator. Lines of latitude are parallel to the equator. That is, each line of latitude remains the same distance from the equator for its entire length around the earth.

latitude

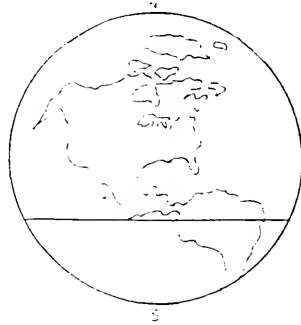


Rote (Free Study) Condition

latitude

latitude

distance
north or
south of
the equator



APPENDIX G
TEACHER TRAINING PROCEDURES

TEACHER TRAINING PROCEDURES

- I. Provide an Overview of the Training.
 - A. Goals and objectives
 - B. Format
- II. Describe Effective Teaching Procedures.
 - A. **A**dvanced organizer
 - B. **R**eview
 - B. **M**odeling and demonstration
 - C. **G**uided practice
 - D. **S**tudent participation (active)
 - E. **R**einforcement (positive)
 - F. **C**orrective feedback
 - G. **E**valuation methods
 - H. First letter mnemonic - "**A**ll **r**ight! **M**y
great **s**tudents **r**eally **c**an **e**xcel."
- III. Introduce Strategy Conditions
 - A. Review research
 - 1. Memory
 - 2. Strategies
 - B. Review methods
 - 1. Keyword mnemonics
 - 2. Contextual analysis
 - 3. Rote
- IV. Random Assignment of Teachers to Condition.
- V. Provide Demonstration of Specific Condition.
- VI. Provide Individual Guided and Independent Practice.
- VII. Assess Teacher Performance Using Time Sampling Form.

APPENDIX H
TIME SAMPLING RECORDING FORM

TIME SAMPLING RECORDING FORM

Teacher _____

Observer _____

Date _____

Time _____

Following Script

Following Sequence

Consistent Pacing

Using Materials Correctly

5				10				15				20			
30	60	30	60	30	60	30	60	30	60	30	60	30	60	30	60

Date _____

Time _____

Following Script

Following Sequence

Consistent Pacing

Using Materials Correctly

5				10				15				20			
30	60	30	60	30	60	30	60	30	60	30	60	30	60	30	60

Date _____

Time _____

Following Script

Following Sequence

Consistent Pacing

Using Materials Correctly

5				10				15				20			
30	60	30	60	30	60	30	60	30	60	30	60	30	60	30	60

Source: Adapted from Peterson, S. K. (1988). The concrete to abstract mathematical instructional sequence with learning disabled students (Doctoral dissertation, University of Florida,). Dissertation Abstracts International, 48, 2040-A.

and Adapted from King-Sears, M. E. (1989). Mnemonic and nonmnemonic science vocabulary instruction with mildly handicapped students (Doctoral dissertation, University of Florida, 1989).

APPENDIX I
TEACHER-PROVIDED KEYWORD MNEMONIC CONDITION TEACHER SCRIPT

Teacher-Provided Keyword Mnemonic Condition Teacher Script

Directions for Geography Term Screening Device

For the next few weeks we are going to be studying terms you will be finding in your geography lessons. Today I want you to take a test that will let me know if you already know any of these words. There are many words on this test. You may not know these words and that's Okay. Just find any words that you do know and write the definitions on the line beside the word. How well you do on this test will not be reflected in your grade, but try your best to get credit for your effort. Do not worry about correct spelling, but be sure to write a complete definition for any words you know. (Distribute to each student a Written Geography Term Definition Screening Device form.)

(Have your name and that day's date on the board.)

Write your name, my name, and today's date at the top of the page in the spaces provided. (Pause for one minute while the students fill in this information.) You have as much time as you need to define as many of these geography terms as you can. Raise your hand when you have written all the definitions for as many words as you can. Please read or work quietly while others finish if you finish the test before the period is up. Are there any questions before you begin?

(Answer any questions.) Ready? Begin? (Collect papers as students finish and at the end of the period.)

Directions for First 4 Weeks of Implementation

Materials: cassette recorder with timing tape, four 5X8 cards for each targeted geography term for that week, index cards (3 x 5), and pencils (for any student without)

Advance Organizer - Day 1

For the next few weeks we are going to be learning many new geography terms that you will need to know. We will be learning a group of these words each week for 4 weeks. We will spend Monday through Thursday learning each weeks' words. You will take a quiz at the end of each of these lessons in order to see how many geography words you are learning. At the end of the week, you will take a test to see how many of the geography words you have remembered. The test at the end of the week and your participation in class will count towards your grade. There are index cards and pencils available for you to take notes if you want to. (Ask questions to review this information such as "What are we going to be learning for the next few weeks?" "Do the daily quizzes count towards your grade?")

Demonstration - Day 1 - (Begin tape in cassette recorder)

Today we are going to learn the meaning of several new words. In order to help you learn and remember the meanings of these words, I want you to use a special strategy. The best way to tell you about the method is to give you some practice learning some example words. (Show first demonstration card.)

This is the word say the word. (Show second card.) Say the word means state the definition. There are two important steps to follow to help you learn and remember this word. The first step is to think of a clue (or key) word or phrase for the geography term. This clue word or phrase sounds like some part of the geography term. (Show the third card.) This key word (or phrase) is say the keyword. You know, like say the keyword that you describe the keyword. What is the geography term we are learning? (Give corrective

feedback, positive reinforcement, and prompts when necessary. Call on several different students to respond.) **And what word is our keyword to think about?** (Continue corrective feedback, positive reinforcement and prompts.)

Remember the meaning of the word say the geography term is say the definition. The keyword is **say the keyword**. For the next step, I will interact the definition with the keyword. (Show fourth card.) Think about this picture of **describe the picture of the definition interacting with the keyword** to help you remember what **say the geography term** means. Think about what? What does **say the geography term** mean? (Provide corrective feedback, positive reinforcement, and verbal prompts. Continue calling on different students to keep all students actively involved. Repeat this process for all three example words.)

Instruction - Day 1

Do you see how the keywords or phrases can help you learn and remember the meanings of new words? (Respond to answers.) Now let's try another word. (Continue providing corrective feedback, positive reinforcement and prompts when necessary throughout the lesson.)

1. The next geography term we are going to learn is **say the word**. (Show Card 1)
2. What's the next word, (call student's name)?
3. **Say the geography term** means **state the definition**. (Show Card 2)
4. What does **say the geography term** mean, (call student's name)?
5. I want you to think **say the keyword**. (Show Card 3)
6. What do we think about to help remember **say the geography term**, (call on student)?

7. Think about say keyword. Describe interaction of keyword into picture of geography term definition.
(Show Card 4)
8. How can you remember say geography term. (Call student name)?
9. What does say geography term mean, (call student name)?
Let's try another word. (Repeat steps 1 through 9 for the remaining targeted terms for Day 1.)

Advance Organizer - Days 2, 3, and 4 - (Begin tape in tape recorder.)

Today you will continue learning the definitions of some new geography terms. We will continue using the keyword strategy like we did yesterday. Remember, we will have a quiz at the end of today's lesson, and there will be a test over all the words we will be learning on Friday. The grade you receive on the test on Friday and your classroom participation will count towards your grade. Let's review the words we learned yesterday.

Review Sequence (Review any particular words that were difficult the previous day.)

1. Yesterday we learned the definition for the word say the geography term.
2. What was the keyword we think of to help us remember the definition (call student name)?
(Reinforce response.)
3. Put say the keyword in the picture of the definition for say the geography term.
4. What does say the geography term mean, (call student name)? (Continue reinforcing responses. Repeat steps 1 through 4 until the three minute bell rings.)

Instructional Sequence

Now we are ready to go over all the words we've been learning this week. (Continue teaching the targeted geography terms for the day using steps 1 through 9 as you did on Day 1.)

Evaluation

Quiz - Days 1, 2, 3, and 4

(Have your name and the date written on the board.)

That's all the words we have time to learn today. Let's see how well you remember what our new geography terms mean. (Distribute a form of the Daily Measure of Geography Terms' Definition Device.) Write your name, my name, and today's date at the top of your quiz. The date and my name are on the board. (Pause for approximately one minute.) Find the words that you know. Write the definition next to the word. Don't worry about spelling, but you need to write a complete definition to get credit. You have 5 minutes. Any Questions? (Answer any questions.) Begin. (Start timer for 5 minutes. Collect the quizzes at the end of 5 minutes. Praise and reinforce appropriate behavior and student participation as you collect papers.)

Test - Day 5

(Have your name and the date written on the board.)

Today you are going to take a test on all the geography terms you have been learning. (Distribute the Geography Terms' Definition Device.) Write your name, my name, and today's date on your test. (Pause for approximately one minute.)

You have learned a lot of new geography terms this week. Try hard to remember the keyword and definitions of these new words. On this test you will

find some words we have not learned yet. Don't worry about these words if you don't know them. Skip any words you don't know or can't remember. Find the words you do know and write the definition of those words. Spelling doesn't count, but you must write a complete definition to get credit. You have 30 minutes to complete this test. Please read or work quietly if you finish before the 30 minute period is over. Are there any questions? (Answer questions.)

Begin. (Set the timer for 30 minutes. Collect the papers as the students finish and at the end of the 30 minute time period. Praise students for their participation and efforts at the end of the period.)

APPENDIX J
TEACHER-PROVIDED CONTEXTUAL ANALYSIS CONDITION TEACHER SCRIPT

Teacher-Provided Contextual Analysis Condition Teacher Script

Directions for Geography Term Screening Device

For the next few weeks we are going to be studying terms you will be finding in your geography lessons. Today I want you to take a test that will let me know if you already know any of these words. There are many words on this test. You may not know these words and that's Okay. Just find any words that you do know and write the definitions on the line beside the word. How well you do on this test will not be reflected in your grade, but try your best to get credit for your effort. Do not worry about correct spelling, but be sure to write a complete definition for any words you know. (Distribute to each student a Written Geography Term Definition Screening Device form.)

(Have your name and that day's date on the board.)
Write your name, my name, and today's date at the top of the page in the spaces provided. (Pause for one minute while the students fill in this information.) You have as much time as you need to define as many of these geography terms as you can. Raise your hand when you have written all the definitions for as many words as you can. Please read or work quietly while others finish if you finish the test before the period is up. Are there any questions before you begin?
(Answer any questions.) Ready? Begin? (Collect papers as students finish and at the end of the period.)

Directions for First 4 Weeks of Implementation.

Materials: cassette recorder with timing tape, timer, three 5 x 8 cards for each targeted geography term for that week, index cards (3 x 5), and pencils (for any student without)

Advance Organizer - Day 1

For the next few weeks we are going to be learning many new geography terms that you will need to know. We will be learning a group of these words each week for 4 weeks. We will spend Monday through Thursday learning each weeks' words. You will take a quiz at the end of each of these lessons in order to see how many geography words you are learning. At the end of the week, you will take a test to see how many of the geography words you have remembered. The test at the end of the week and your participation in class will count towards your grade. There are index cards and pencils available for you to take notes if you want to. (Ask questions to review this information such as "What are we going to be learning for the next few weeks?" "Do the daily quizzes count towards your grade?")

Demonstration - Day 1 (Begin tape in cassette recorder)

Today we are going to learn the meaning of several new words. In order to help you learn and remember the meanings of these words, I want you to use a special strategy. The best way to tell you about the method is to give you some practice learning some example words. (Show first demonstration card.)

This is the word say the word. Many times it is easy to tell the meaning of a word from the way the word is used in a sentence. You will often find clues to the meanings of words. It is important that you learn to recognize some of these clues. Sometimes the definition is in the same sentence as a word. Look for words like "or" and "that is". Sometimes the clue to the meaning of a word appears in the sentence before the word. The clue may also appear in the sentence after the word. Other clues that indicate the meaning of a word may be a dash -, or parentheses

(). (Point to the chart and review the clues. Call on students to name a clue. Reinforce participation and answers.) **Remember these clues.** (Show second card.) **Read the sentences on Card 2.** (Discuss how the bolded clues relate to the targeted geography term on Card 1. Find the specific clue(s) on the chart that pertain to the context clues for the targeted term.) **See how say the bolded clue(s) on the card is a clue to help us understand the meaning of say the targeted term.** (Show third card.) This illustration also helps us understand the meaning of **say the word.** What is the geography term we are learning? (Give corrective feedback, positive reinforcement, and verbal prompts when necessary. Call on several different students to respond.) **And what context clues help us to understand the meaning of say the word?** (Continue corrective feedback, positive reinforcement and verbal prompts. Continue calling on different students to keep all students actively involved.) **Remember the meaning of the word say the geography term is say the contextual definition.** (Show all three cards in sequence. Repeat this process for all three example words.)

Instruction - Day 1

Do you see how context clues can help you learn and remember the meanings of new words? (Respond to answers.) Now let's try another word. (Continue providing corrective feedback, positive reinforcement and prompts when necessary throughout the lesson.)

1. The next geography term we are going to learn is **say the word.** (Show Card 1)
2. What's the next word, (call student's name)?
3. I want you to look for the context clues that will help us learn what **say the word** means. (Show Card 2)

4. **What do we look for when we're looking for context clues,** (call student's name)? (Point to the chart).
5. (Read Card 2) **What clues are we given to understand what say the word means,** (call student's name)?
6. **What does say the geography term mean,** (call student's name)?
7. **Remember** (Show Card 3) **say the word means say the contextual definition.**
Let's try another word. (Repeat steps 1 through 7 for the remaining targeted terms for Day 1.)

Advance Organizer - Days 2, 3, and 4 - (Begin tape in tape recorder.)

Today you will continue learning the definitions of some new geography terms. We will continue using the keyword strategy like we did yesterday. Remember, we will have a quiz at the end of today's lesson, and there will be a test over all the words we will be learning on Friday. The grade you receive on the test on Friday and your classroom participation will count towards your grade. Let's review the words we learned yesterday.

Review Sequence (Review any particular words that were difficult the previous day.)

1. **Yesterday we learned the definition for the word say the geography term.**
2. **What were the context clues that helped us define say the geography term,** (call student name)?
 (Reinforce responses)
3. **What does say the geography term mean,** (call student name)?
 (Continue reinforcing responses. Repeat steps 1 through 3 until the three minute bell rings.)

Instructional Sequence

Now we are ready to go over all the words we've been learning this week. (Continue teaching the targeted geography terms for the day using steps 1 thorough 7 as you did on Day 1.)

Evaluation

Quiz - Days 1, 2, 3, and 4

(Have your name and the date written on the board.)

That's all the words we have time to learn today. Let's see how well you remember what our new geography terms mean. (Distribute a form of the Daily Measure of Geography Terms' Definition Device.) Write your name, my name, and today's date at the top of your quiz. The date and my name are on the board. (Pause for approximately one minute.) Find the words that you know. Write the definition next to the word. Don't worry about spelling, but you need to write a complete definition to get credit. You have 5 minutes. Any Questions? (Answer any questions.) Begin. (Start timer for 5 minutes. Collect the quizzes at the end of 5 minutes. Praise and reinforce appropriate behavior and student participation as you collect papers.)

Test - Day 5

(Have your name and the date written on the board.)

Today you are going to take a test on all the geography terms you have been learning. (Distribute the Geography Terms' Definition Device.) Write your name, my name, and today's date on your test. (Pause for approximately one minute.)

You have learned a lot of new geography terms this week. Try hard to remember the context clues and definitions of these new words. On this test you will

find some words we have not learned yet. Don't worry about these words if you don't know them. Skip any words you don't know or can't remember. Find the words you do know and write the definition of those words. Spelling doesn't count, but you must write a complete definition to get credit. You have 30 minutes to complete this test. Please read or work quietly if you finish before the 30 minute period is over. Are there any questions? (Answer questions.)

Begin. (Set the timer for 30 minutes. Collect the papers as the students finish and at the end of the 30 minute time period. Praise student's for their participation and efforts at the end of the period.)

(Listed on Chart)

Context Clues to Help You

1. The **sentence before** the word
2. The **sentence after** the word
3. The **definition in** the sentence

Look For ---

- A. **Or**
 - B. **That is**
 - C. **Dash -**
 - D. **Parentheses ()**
4. Also look for **pictures, graphs, diagrams, tables,**
and **maps** to help understand new terms.

APPENDIX K
ROTE FREE-STUDY CONDITION TEACHER SCRIPT

Rote Free-Study Condition Teacher Script

Directions for Geography Term Screening Device

For the next few weeks we are going to be studying terms you will be finding in your geography lessons. Today I want you to take a test that will let me know if you already know any of these words. There are many words on this test. You may not know these words and that's Okay. Just find any words that you do know and write the definitions on the line beside the word. How well you do on this test will not be reflected in your grade, but try your best to get credit for your effort. Do not worry about correct spelling, but be sure to write a complete definition for any words you know. (Distribute to each student a Written Geography Term Definition Screening Device form.)

(Have your name and that day's date on the board.) Write your name, my name, and today's date at the top of the page in the spaces provided. (Pause for one minute while the students fill in this information.) You have as much time as you need to define as many of these geography terms as you can. Raise your hand when you have written all the definitions for as many words as you can. Please read or work quietly while others finish if you finish the test before the period is up. Are there any questions before you begin? (Answer any questions.) Ready? Begin? (Collect papers as students finish and at the end of the period.)

Directions for First 4 Weeks of Implementation.

Materials: cassette recorder with timing tape, timer, two 5X8 cards for each targeted geography term for that week, index cards (3X5), and pencils (for any student without)

Advance Organizer - Day 1

For the next few weeks we are going to be learning many new geography terms that you will need to know. We will be learning a group of these words each week for 4 weeks. We will spend Monday through Thursday learning each weeks' words. You will take a quiz at the end of each of these lessons in order to see how many geography words you are learning. At the end of the week, you will take a test to see how many of the geography words you have remembered. The test at the end of the week and your participation in class will count towards your grade. There are index cards and pencils available for you to take notes if you want to. (Ask questions to review this information such as "What are we going to be learning for the next few weeks?" "Do the daily quizzes count towards your grade?")

Demonstration - Day 1 - (Begin tape in cassette recorder)

Today we are going to learn the meaning of several new words. In order to help you learn and remember the meanings of these words, I want you to use a special strategy. The best way to tell you about the method is to give you some practice learning some example words. (Show first demonstration card.)

This is the word say the word. Some times it helps to learn and remember a word if you repeat the word and the definition over and over again. This repitition can be done by saying the word and definition repeatedly. You may chose any strategy you perfer - either writing or saying the word and definition repeatedly - to help you remember. (Show second card.) Say the word means say the definition. What is the geography term we are learning? (Give corrective

feedback, positive reinforcement, and verbal prompts when necessary. Call on several different students to respond.) **And what kind of repetition can help us remember the meaning of say the word?** (Continue corrective feedback, positive reinforcement and verbal prompts. Continue calling on different students to keep all students actively involved.) **Remember the meaning of the word say the geography term is say the definition.** (Show the two cards in sequence. Repeat this process for all three example words.)

Instruction - Day 1

Do you see how repetition can help you learn and remember the meanings of new words? (Respond to answers.) **Now let's try another word.** (Continue providing corrective feedback, positive reinforcement and prompts when necessary throughout the lesson.)

1. **The next geography term we are going to learn is say the word.** (Show Card 1)
2. **What's the next word,** (call student's name)?
3. **I want you to either say or write the word say the word.**
4. **Say the word means say the definition.** (Show Card 2)
5. **I want you to either say or write say the definition.**
6. **What does say the geography term mean,** (call student's name)?
7. **Remember (Show Card 1) say the word means say the definition.**

Let's try another word. (Repeat steps 1 through 7 for the remaining targeted terms for Day 1.)

Advance Organizer - Days 2, 3, and 4 (Begin tape in tape recorder.)

Today you will continue learning the definitions of some new geography terms. We will continue using the rote free study strategy like we did yesterday. Remember, we will have a quiz at the end of today's lesson, and there will be a test over all the words we will be learning on Friday. The grade you receive on the test on Friday and your classroom participation will count towards your grade. Let's review the words we learned yesterday.

Review Sequence (Review any particular words that were difficult the previous day.)

1. Yesterday we learned the definition for the word say the geography term.
2. Think back to you repeating the word and definition yesterday.
3. What does say the geography term mean, (call student name)?
(Continue reinforcing responses. Repeat steps 1 through 3 until the three minute bell rings.)

Instructional Sequence

Now we are ready to go over all the words we've been learning. (Continue teaching the targeted geography terms for the day using steps 1 thorough 7 as you did on Day 1.)

Evaluation

Quiz - Days 1, 2, 3, and 4

(Have your name and the date written on the board.)

That's all the words we have time to learn today. Let's see how well you remember what our new geography terms mean. (Distribute a form of the Daily Measure of

Geography Terms' Definition Device.) **Write your name, my name, and today's date at the top of your quiz. The date and my name are on the board.** (Pause for approximately one minute.) **Find the words that you know. Write the definition next to the word. Don't worry about spelling, but you need to write a complete definition to get credit. You have 5 minutes. Any Questions?** (Answer any questions.) **Begin.** (Start timer for 5 minutes. Collect the quizzes at the end of 5 minutes. Praise and reinforce appropriate behavior and student participation as you collect papers.)

Test - Day 5

(Have your name and the date written on the board.)

Today you are going to take a test on all the geography terms you have been learning. (Distribute the Geography Terms' Definition Device.) **Write your name, my name, and today's date on your test.** (Pause for approximately one minute.)

You have learned a lot of new geography terms this week. Try hard to remember the words and definitions of these new words you have either said or written repeatedly. On this test you will find some words we have not learned yet. Don't worry about these words if you don't know them. Skip any words you don't know or can't remember. Find the words you do know and write the definition of those words. Spelling doesn't count, but you must write a complete definition to get credit. You have 30 minutes to complete this test. Please read or work quietly if you finish before the 30 minute period is over. Are there any questions? (Answer questions.) **Begin.** (Set the timer for 30 minutes. Collect the papers as the students finish and at the end of the 30 minute time period. Praise student's for their participation and efforts at the end of the period.)

APPENDIX L
MEAN RAW SCORES ON WRITTEN ASSESSMENTS

Mean Raw Scores on Written Assessments

Week	1	2	3	4	7
Keyword					
Acquisition	3.74	3.80	3.27	3.99	
Short-Term	7.56	12.81	11.92	12.33	
Long-Term					10.42
Contextual					
Acquisition	1.56	2.69	1.56	1.17	
Short-Term	2.75	6.72	3.87	5.83	
Long-Term					6.61
Rote					
Acquisition	4.43	5.16	4.10	6.03	
Short-Term	6.49	12.64	11.97	17.44	
Long-Term					13.50

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BIOGRAPHICAL SKETCH

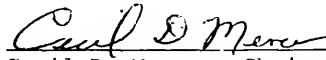
Shirley N. Fox was born on June 17, 1953, in Bethesda, Maryland. Prior to the age of nine, she lived in Virginia, Panama, and California. In 1962, her family settled in St. Petersburg, Florida.

Shirley graduated from Lakewood High School and then attended Pfeiffer College in Meisenheimer, North Carolina. In 1974, she transferred to the University of Florida and earned a Bachelor of Science in Education Degree with teaching certificates in early childhood and elementary education. Shirley began part-time graduate study in 1977 at the University of Florida. She completed her M.Ed. in special education in 1980 and was certified to teach learning disabled and emotionally handicapped students. She began a part-time doctoral study in 1983. Her Ph.D. major is in special education with an emphasis on mildly handicapped students. Additional areas of study include early childhood education and educational administration.

Shirley's work experiences include teaching, consulting, and administration. In 1976, Shirley was hired as a teacher at a private school. Next, Shirley worked for the Alachua County School System. She taught mildly handicapped adolescents at Lincoln Middle School where she was also team leader for the Exceptional Student Education Department.

After six years at Lincoln Middle School, Shirley was hired as a classroom teacher and later a liaison consultant for the University of Florida Multidisciplinary Diagnostic and Training Program (MDTP). After seven years with the MDTP, Shirley moved to Orlando, Florida, where she became a behavior specialist for the Orange County School System. After 1 year, she was promoted to assistant principal at Magnolia Exceptional School, a school for severely handicapped students. After 3 years as an assistant principal of secondary programs at Magnolia School, Shirley was transferred to assistant principal of instruction at Robert E. Lee Middle School in fulfillment of the Preparing New Principals Program (PNPP) for Orange County Administrators. Shirley will be completing her principal internship and the PNPP for the Orange County School System in the spring of 1993.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.



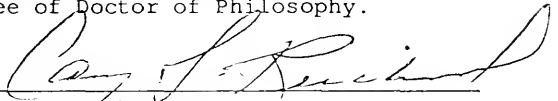
Cecil D. Mercer, Chair
Professor of Special Education

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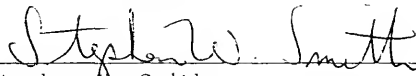
Cynthia C. Griffin
Assistant Professor of Special
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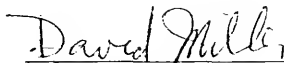
Cary L. Reichard
Professor of Special Education

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.



Stephen W. Smith
Assistant Professor of Special
Education

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.



David Miller
Associate Professor of Foundations
of Education

This dissertation was submitted to the Graduate Faculty of the College of Education and to the Graduate School and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

May 1993

Dean, College of Education

Dean, Graduate School

UNIVERSITY OF FLORIDA



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